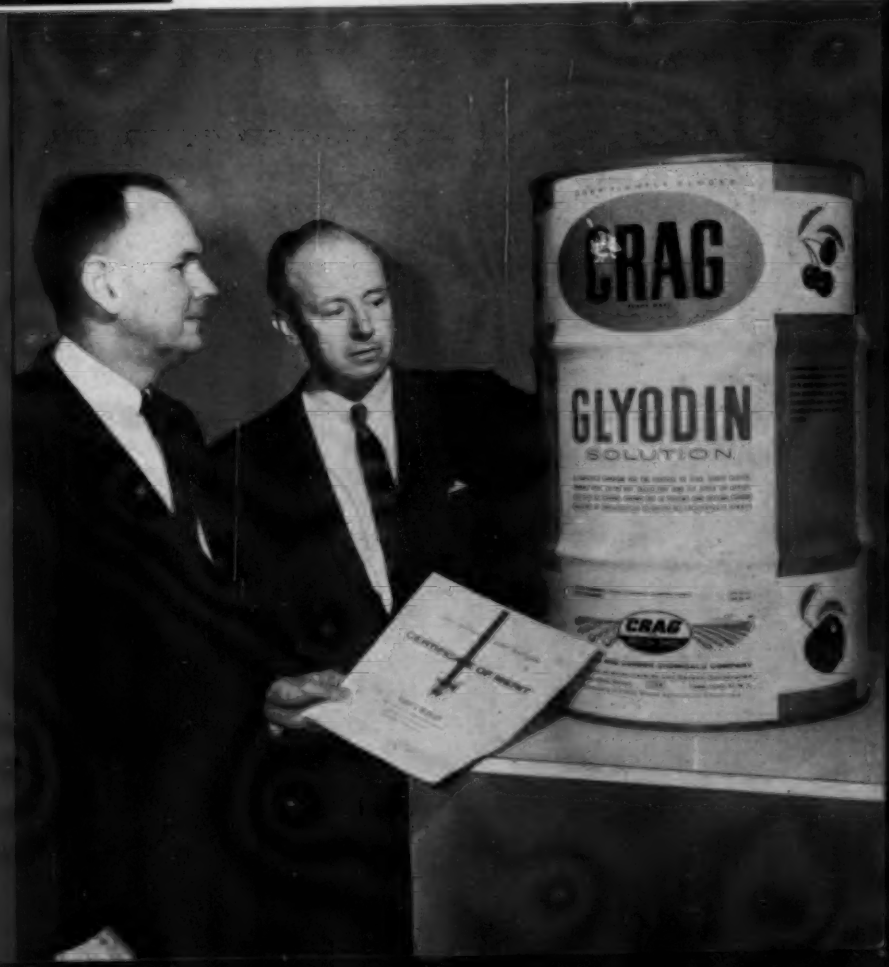
AGRICULTURAL *Chemicals*

IN THIS ISSUE:

Review on Gibberellins
Foliage Fungicides
NAC Spring Report
Insect Resistance
New Plant Layout
Triple S Analysis
1956 Fungicide Tests
Soil Fumigation

APRIL, 1957



GIANT SERVANT OF AGRICULTURE

Potash requirements have changed over the years. P.C.A. has kept abreast of this change and offers the following products:

New 60% Standard Muriate
New 60% Special Granular Muriate
New 60% Coarse Granular Muriate
Sulphate of Potash
Chemical Muriate

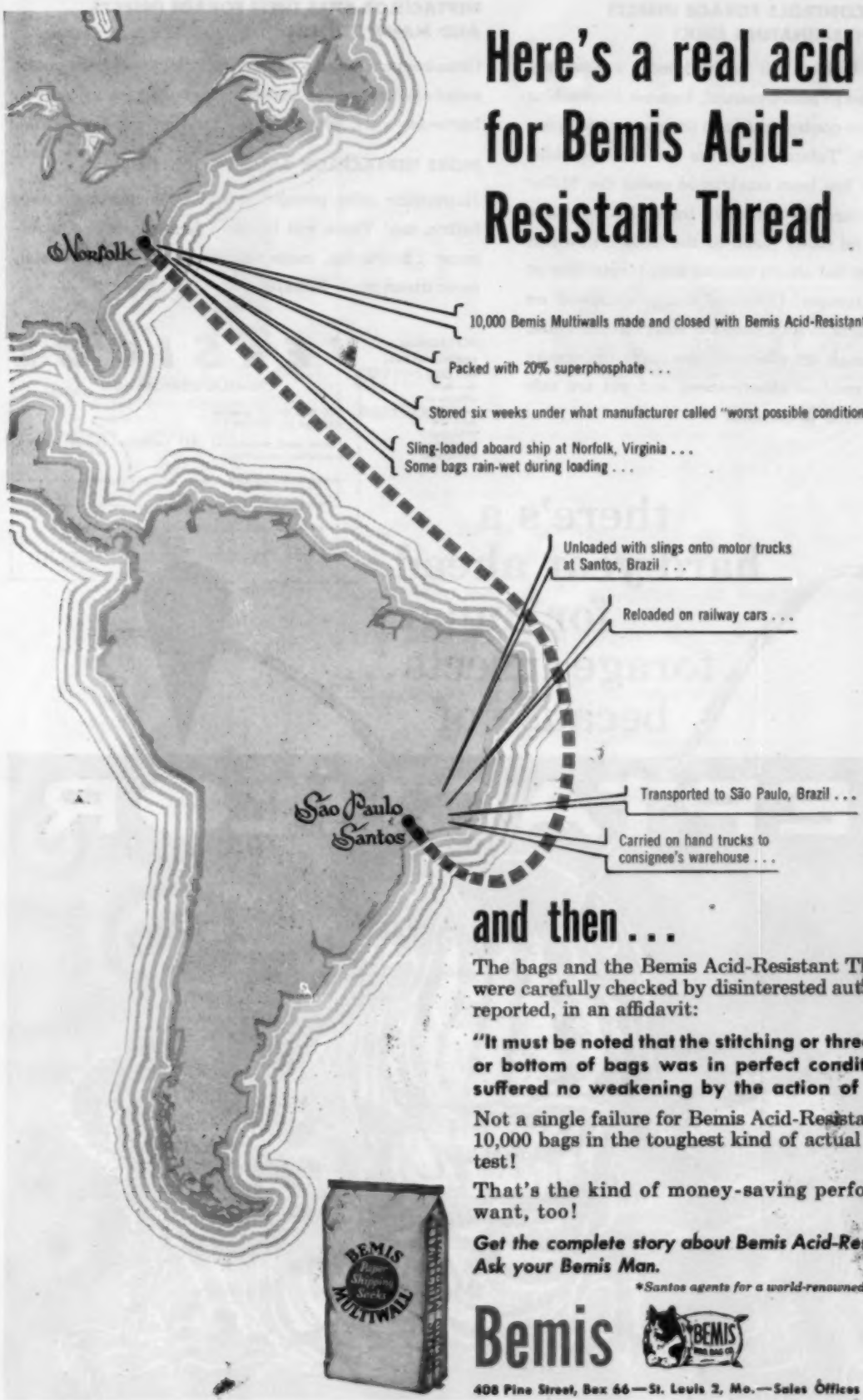
Quick Service — High Quality

POTASH COMPANY OF AMERICA

CARLSBAD, NEW MEXICO.

General Sales Office . . . 1625 Eye Street, N.W., Washington, D.C.
Midwestern Sales Office . . . First National Bank Bldg., Peoria, Ill.
Southern Sales Office . . . Candler Building, Atlanta, Ga.

Here's a real acid test for Bemis Acid-Resistant Thread


Norfolk
10,000 Bemis Multiwalls made and closed with Bemis Acid-Resistant Thread . . .
Packed with 20% superphosphate . . .
Stored six weeks under what manufacturer called "worst possible conditions"...
Sling-loaded aboard ship at Norfolk, Virginia . . .
Some bags rain-wet during loading . . .
Unloaded with slings onto motor trucks at Santos, Brazil . . .
Reloaded on railway cars . . .
São Paulo
Santos
Transported to São Paulo, Brazil . . .
Carried on hand trucks to consignee's warehouse . . .
BEMIS
Bemis Shipping Sacks
MULTIWALL

and then . . .

The bags and the Bemis Acid-Resistant Thread sewing were carefully checked by disinterested authorities* who reported, in an affidavit:

"It must be noted that the stitching or thread at the top or bottom of bags was in perfect condition . . . and suffered no weakening by the action of the goods."

Not a single failure for Bemis Acid-Resistant Thread in 10,000 bags in the toughest kind of actual performance test!

That's the kind of money-saving performance you want, too!

Get the complete story about Bemis Acid-Resistant Thread. Ask your Bemis Man.

**Santos agents for a world-renowned underwriting [illegible]*

Bemis

408 Pine Street, Box 66—St. Louis 2, Mo.—Sales Offices in Principal Cities

HEPTACHLOR CONTROLS FORAGE INSECTS WITHOUT CONTAMINATING MILK!

This year, Heptachlor will be used more extensively than ever for forage insect control, because Heptachlor provides effective control of forage insects without contaminating milk. Tolerance for the use of Heptachlor on forage crops has been established under the Miller Bill, and confirmed by extensive tests. Among these tests was a special study made by the USDA, in which dairy cattle were fed alfalfa treated with Heptachlor at recommended dosages. Chemical analysis showed no trace of Heptachlor in milk from the test cattle. Because Heptachlor is such an effective insecticide, minimum amounts have residual effectiveness, and yet are safe for use on crops fed to animals.

HEPTACHLOR KILLS THESE FORAGE INSECTS AND MANY OTHERS!

Grasshoppers, alfalfa weevils, spittlebugs, leafhoppers, sweet clover weevils, cutworms, lygus bugs, armyworms, harvester ants, plant bugs, Egyptian alfalfa weevils.

MORE HEPTACHLOR SALES PROMOTION

Heptachlor sales promotion will be bigger than ever before, too! There will be more farm paper and newspaper advertising, more dealer promotional material, more direct mail, literature, and publicity.

HEPTACHLOR FORMULATORS! Mail coupon now for samples of Heptachlor materials to be used in Forage Insect Promotions!

VELSICOL

CHEMICAL CORPORATION AC-4

330 East Grand Avenue
Chicago 11, Illinois

Please send samples of 1957 Heptachlor Forage Insect promotion materials.

Name_____

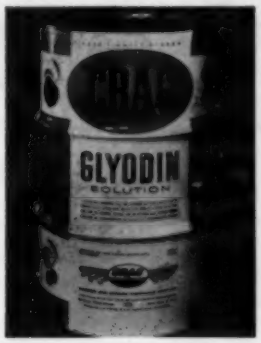
Company_____

Address_____

City_____ Zone_____ State_____

there's a hard year ahead for hungry forage insects... because of

HEPTACHLOR



This Month's Cover

R. H. Wellman, manager of the agricultural chemicals division, Union Carbide and Carbon Chemicals Co., holds certificate of merit awarded for the design of Carbide's container for "Crag Gloydin," a fruit fungicide. Standing by is Francis E. Blod, president of the Package Designers Council. The container was an award winner in the third annual American Package Design Competition.

Vol. 12, No. 4 April, 1957

AGRICULTURAL Chemicals

ARTICLES

GIBBERELLIC ACID: A POTENTIAL AGRICULTURAL CHEMICAL 30
By H. T. Kemp, R. G. Fuller, and R. S. Davidson

FOLIAGE FUNGICIDES AND COMBINATION SPRAYS 32
By R. H. Daines

NEW CONCEPT IN PLANT LAYOUT 35
By James E. Madigan

CREDIT, FINANCE, PROFITS HIGHLIGHT NAC SPRING DISCUSSIONS.. 37

RESISTANCE IN COTTON PESTS TO INSECTICIDES 41
By R. C. Gaines

ALABAMA PEST CONTROL CONFERENCE 44

SOIL FUMIGATION WITH VAPAM 47

ANALYSIS OF TRIPLE SUPERPHOSPHATE 48
By H. L. Replogle and H. S. Marshall

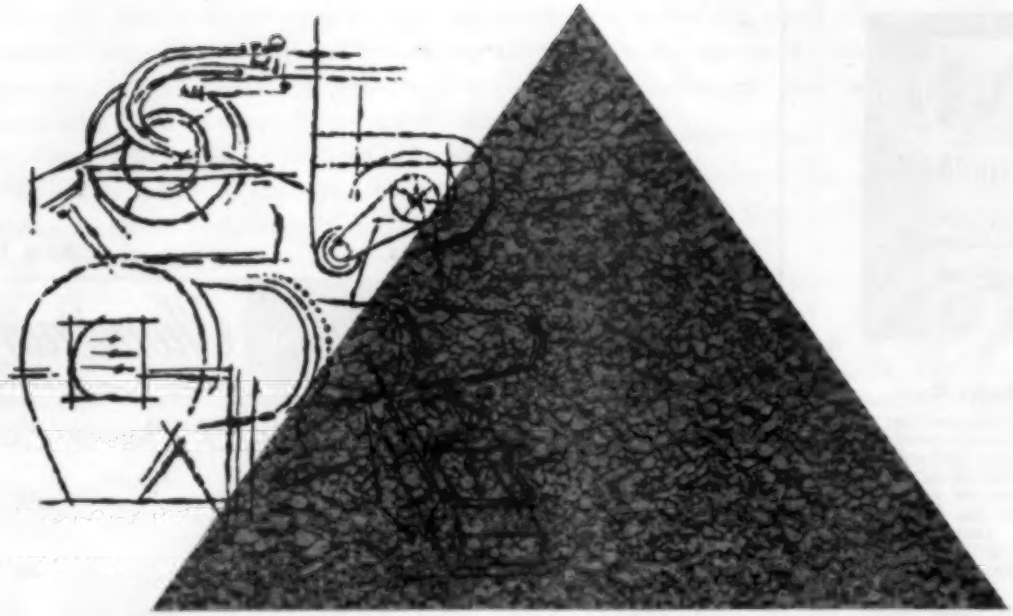
1956 FUNGICIDE TESTS . . . Part 3 62

FEATURES

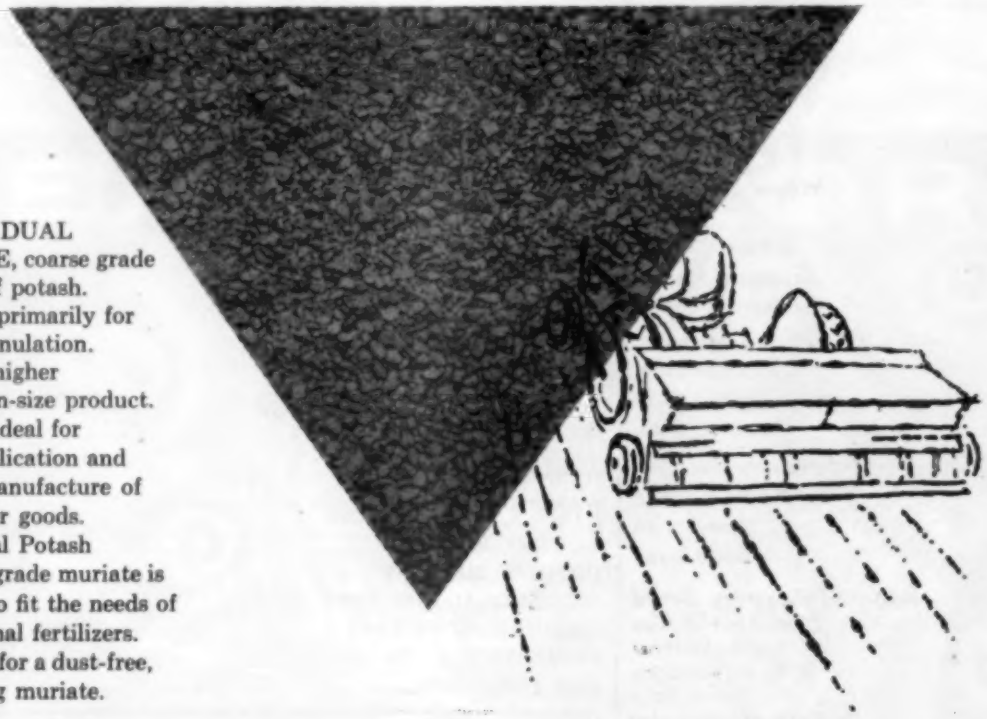
IN THE SPOTLIGHT THIS MONTH 7
INDUSTRY CALENDAR 22
EDITORIALS 29
THE LISTENING POST 52
By Kelvin Dorward and Paul Miller
FERTILIZER VIEWS AND NEWS 57
By Vincent Sauchelli
TECHNICAL SECTION 67
WASHINGTON REPORT 73
By Donald Lerch
INDUSTRY NEWS 75
SUPPLIERS' BULLETINS 96
PROFESSIONAL DIRECTORY 124
CLASSIFIED ADVERTISING 123
ADVERTISER'S INDEX 125
TALE ENDS 126

Publisher
Wayne E. Dorland
Editor
Eleonore Kanar
Associate Editor
Richard McNally
Advertising Manager
Ralph Dorland
Eastern District Manager
Roger Appleby
Midwestern Manager
Robert F. Garty
Circulation
David Tryon
Editorial Advisory Board
Dr. Alvin J. Cox
Lea S. Hitchner
Dr. S. E. A. McCallan
Dr. Charles Palm
Dr. Colin W. Whittaker

PUBLISHED monthly on the 1st, by Industry Publications, Inc.
ADVERTISING and Editorial Office, P. O. Box 31, Caldwell, New Jersey.
PUBLICATION Office: 123 Market Pl., Baltimore, Md.
CHICAGO ADDRESS: P. O. Box 135, Park Forest, Ill. SKyline 6-4499.
ENTERED as second-class matter November 4, 1949 at the Post Office at Baltimore, Md., under the Act of March 3, 1879.
SUBSCRIPTION RATES: United States, 1 year, $3.00; 2 years, $5.00. Canada and Pan American countries, 1 year, $4.00; 2 years, $7.00. All other foreign countries, 1 year, $9.00; 2 years, $15.
SINGLE COPIES: current issue: $0.50; all back numbers $1.00. Postage and handling charges for foreign countries on single copies: $1.00. Claims for missing numbers will not be allowed if received more than 60 days from date of mailing. No claims allowed from subscribers arising from failure to notify the Circulation department of a change of address, or because a copy is "missing from files."
ADVERTISING RATES known on request. Closing date for copy—5th of month preceding month of issue.



LET NATIONAL POTASH SERVE YOU



Here is a DUAL PURPOSE, coarse grade muriate of potash. Designed primarily for use in granulation. It gives a higher yield of on-size product. It is also ideal for direct application and for the manufacture of top dresser goods.

National Potash standard grade muriate is designed to fit the needs of conventional fertilizers. Processed for a dust-free, non-caking muriate.

NATIONAL POTASH COMPANY
205 EAST 42nd ST. • NEW YORK 17, N. Y.

Inhibitors:

In the January, 1957 issue. there is an article regarding Nalco Corrosion Inhibitor." Would you kindly give us the complete address of The National Aluminate Corp., Chicago, so that we may write them. Or, if you wish, you could inform them that we would like to have more information concerning their product, "Nalco 889."

Wayne D. Gregg
KAUAI PINEAPPLE CO., LTD.,
Lawai, Kauai, Hawaii

To V. Sauchelli:

The last column in AGRICULTURAL CHEMICALS, *Fertilizer Views and News*, was very timely, with worthwhile information.

You, (Dr. Vincent Sauchelli) are one of the few people in the fertilizer industry in a position to acquire the information so as to ably discuss the newer developments and their implications.

Frank App
SEABROOK FARMING CORP.
Seabrook, N. J.

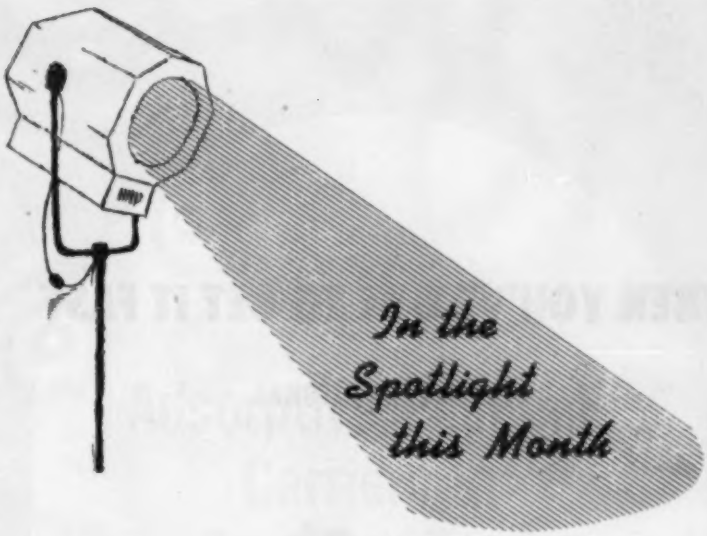
About Malathion:

I am making a very urgent appeal to you for information on the new phosphate, Malathion, a product of American Cyanamid Co., New York. Our office (Cornwall) receives your valuable publication, and in my perusal and study of it I came across the article written by C. Boyd Schaffer (January, 1957, page 34). It particularly interested me and claimed my attention, because of the fact that a workman employed on my grain farm in 1955 claims that he is suffering ill effects as a result of using this Malathion product in the treatment of grain prior to sowing it that spring. At the present time, he is in the hospital, . . . numbness of limbs and back pains are some of the symptoms, — and I understand there is some threat of a suit against us.

I note your suggestion on page 8 to the effect that a technically trained staff is at our service to interpret the information in various featured articles, hence I am writing you to get all the information possible on this product . . . its composition . . . reaction under all conditions, hazards to man or animals, necessary precautions, to what extent it is poisonous, and if so, how soon and in what form does the objectionable reaction occur in men working with this product?

Would it be possible for you to contact the writer of the article, also American Cyanamid Co. of New York and mail to me at your earliest convenience all the information possible on this phosphate, Malathion, — to what extent it is poisonous, its record of safety, and any informa-

(*Continued on Page 20*)



- **Making a Profit** . . . Per cent return on the invested dollar is the critical factor in any business. Fred Shanaman gives NAC representatives a picture of the return on capital necessarily employed in the agricultural chemicals industry, and points to the need for changing the unfavorable industry pattern of excessive stocks, slow turnover, and late collections. Page 37.

- **New Insecticides** . . . Def, a new cotton defoliant and Sevin, a low toxicity insecticide for fruit and cotton insects share new product spotlight at Alabama Pest Control Meeting. Page 44.

- **Fungicides in Combination** . . . Although considered inert, fillers frequently influence materially the fungitoxic or phytotoxic properties of fungicide mixtures. Inactivation of Streptomycin by certain clays through absorption cited as an example. Page 32.

- **Plant Layout** . . . Construction of the GLF plant at Big Flats, N. Y., incorporates new ideas in layout, featuring a main floor free of production equipment. Page 35.

- **Soil Fumigation** . . . Suggested for preparation of tobacco seed beds. Vapam is finding wider use in the home garden market. Several formulators and marketers of garden and household chemicals are considering retailing the material on a national basis. Page 47.

- **Gibberellins** . . . A factual summary of the properties, effects, and potential of this new material now getting its share of the spotlight in the agricultural chemicals industry. Page 30.

- **Fertilizer Equipment** . . . Modern free-flowing high analysis fertilizers require more efficient application equipment, — but manufacturers claim farmers do not know what they really need. Obsolete distributors, drills and planters among equipment which should be redesigned. Page 57.

WHEN YOU'VE GOT TO GET IT FAST

DIAL INTERNATIONAL

Need more phosphate in a hurry? Call *International*. You'll get it fast! That's one reason so many plants depend on *International*—for here are the resources and facilities to give you extra-special service as a matter of simple routine. This service is yours to command, yours to depend on because of *International's* huge production and enormous storage capacity at mines and plants in Florida and Tennessee. You have available a full range of grades of quality-controlled phosphates and a traffic service that will meet your most exacting schedules.

for Industry

and Agriculture

quality controlled...

PHOSPHATE ROCK

★ for the manufacture of complete fertilizers
★ for the manufacture of industrial chemicals
★ ground rock phosphate for direct application to the soil

PHOSPHATE MINERALS DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

GENERAL OFFICES: 20 NORTH WACKER DRIVE, CHICAGO 6

PHOSPHATE MINES AND PLANTS IN FLORIDA AT NORALYN, PEACE VALLEY, ACHAN, MULBERRY; IN TENNESSEE AT MT. PLEASANT, WALES AND GODWIN

FLOREX

Adsorptive Pesticide Carriers in Granular Form

For Granular Insecticides, Soil Fumigants and other Pesticide Formulations

Carefully controlled size fractions, such as 30/60 and 20/40 mesh*, available in various types to meet water-breakdown requirements or to resist disintegration in water. Florex products are derived from selected attapulgite fullers earth.

Use the Floridin Company quality trio to solve your pesticide formulating problems and to produce superior wettable powders, dust base concentrates, finished dusts and granular pesticides.

Have you received the new Floridin bulletin on agricultural chemical processing? It's free; write today.

*Actual Mesh Size Illustrated Above

FLORIDIN COMPANY

Adsorbents
Desiccants
Diluents

DEPT. M, P.O. BOX 989, TALLAHASSEE, FLORIDA

one of the Geigy "Big 4"

SELL THE FLY CONTROL CHEMICAL EVERYBODY'S TALKING ABOUT

DIAZINON

FORMULATIONS

one spraying kills flies for 4-6 weeks

DIAZINON, A PRODUCT OF GEIGY RESEARCH IS THE MOST EFFECTIVE FLY CONTROL CHEMICAL AVAILABLE. Two or three residual sprays of DIAZINON will control flies all season in dairy barns and other farm buildings.

Because of its long residual action, DIAZINON is low in cost. Since only 4 lbs. of the 25% wettable powder in 25 gals. of water is required to treat the average size dairy barn, fly control protection with DIAZINON amounts to only a few cents per day.

Combined with good sanitation and management practices, DIAZINON provides an excellent fly control program. DIAZINON knocks flies down fast and is effective against strains which have become resistant to other types of fly control chemicals.

DIAZINON is also preferred for control of flies in barns housing other livestock and for maggot control in manure pits.

DIAZINON IS AVAILABLE AS:

- *GEIGY DIAZINON 25W (25% wettable powder) in 4 lb. bags and 1 lb. canisters.*
- *GEIGY DIAZINON 25E (25% emulsifiable solution) in 1 pt. bottles, 1 gal. jugs, 5 gal. drums.*

3 more of the Geigy "Big 4"

METHOXYCHLOR

"General purpose" insecticide to round out fly control programs. Direct applications of GEIGY METHOXYCHLOR to livestock (or use in backrubbers or cable treaters) are effective in controlling horn flies, and cattle lice. Low toxicity to man and animals. Long residual action against insects.

CHLOROBENZILATE

Safe, effective miticide for control of various species of mites on apples, pears, azaleas, holly, spruce, and other ornamental and agricultural crops. Long residual action. Relatively non-toxic to bees.

SEQUESTRENE*

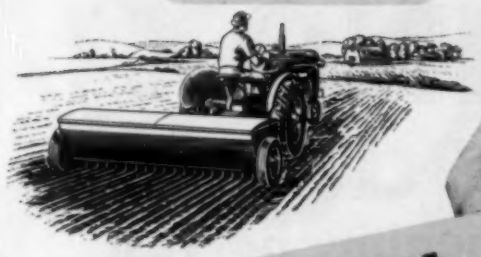
The original metal chelates in the field of agriculture. Completely water soluble, compatible with fertilizers and most pesticides. Designed for the correction of iron deficiency (chlorosis) in ornamentals, fruit trees, vegetables, and turf.

*"SEQUESTRENE" is the brand name for metal chelates sold by Geigy Agricultural Chemicals, Division of Geigy Chemical Corporation

ORIGINATORS OF Geigy DDT INSECTICIDES

GEIGY AGRICULTURAL CHEMICALS Division of Geigy Chemical Corporation **SAW MILL RIVER ROAD, ARDSLEY, NEW YORK**

TENNESSEE CORPORATION



GRANULAR

TRIPLE SUPERPHOSPHATE

For Direct Soil Application

As in all U. S. Phosphoric Products, Granular Triple Superphosphate is produced under the most exacting chemical and physical controls to furnish you and your customers a product of consistent uniform particle size, completely dust free with low moisture content that will not cake or lump in storage or bridge over in the hopper. It drills free to provide the desired amount of plant food through even, uniform flow and distribution.

RIGID QUALITY CONTROL
Through Six Basic Chemical and Physical Analysis

HIGH WATER SOLUBILITY
High Water Solubility is a Characteristic of all 3 Grades

RUN-OF-PILE
Fine Texture, Highest Porosity, Large Surface Area, Small Particle Size, for Maximum Ammoniation-Granulation.

GRANULAR
Dust Free, Free Flowing, Uniform Particle Size, Medium Hardness, No Bridging Over, for Direct Soil Application.

COARSE
For Intermediate Ammoniation to Produce a Semi-Granular Product. Also Affords Excellent Compatable Mixing with Granular Potash, for Minimum Segregation, in Alkaline Grades.

GUARANTEED 46% A.P.A.

Available in Bags or Bulk

There's a **BRADLEY & BAKER** office near you. Their representative would be pleased to consult with you on your requirements and to advise on your most convenient delivery routings.

U.S. PHOSPHORIC PRODUCTS
TAMPA, FLORIDA

Division TENNESSEE CORPORATION

SALES AGENT:
BRADLEY & BAKER
155 East 44th Street—New York 17, New York
DISTRICT SALES OFFICES:
Atlanta, Ga. Indianapolis, Ind. St. Louis, Mo.
Norfolk, Va.

a word to the wise

SINOX® Products

...for a healthy harvest in crops and profits

Growers and Dealers like the "Standard Ag." line because it returns both *satisfaction and profit.*

Growers find that SINOX PE, SINOX GENERAL, and other well-known products in the "Standard" line give them higher yields and better quality crops, for a higher dollar profit.

Dealers likewise enjoy the pleasure and profit that always go hand-in-hand with satisfied customers.

Standard Agricultural Chemicals products are sold on a performance basis—they get results, and they do their work as promised.

Take a tip—join "Standard." Write us for complete information.

STANDARD AGRICULTURAL CHEMICALS, INC.

1301 JEFFERSON STREET, HOBOKEN, N. J.
429 FORUM BUILDING, SACRAMENTO, CALIF.

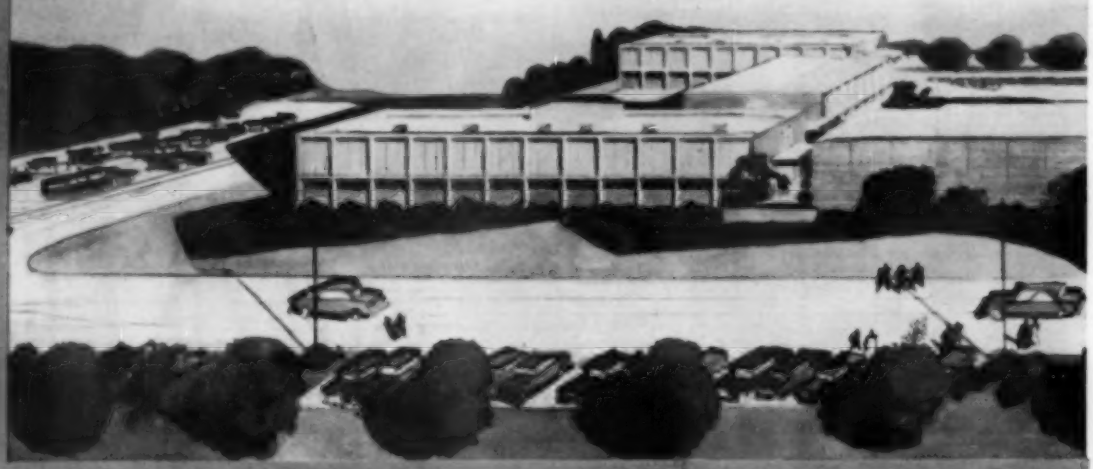
POTASH RAISES FARM INCOME. The successful American wheat farmer. He knows all there is to know about plowing, planting and harvesting. He knows the value of potash-enriched fertilizers, too. If he cared to talk about his success, he'd probably tell us he replenishes the potash in his soil every year. And every fall, like clockwork, he reaps the full healthy crop that is his due. Chances are he spends no more time in the field than any other farmer. A little wiser, that's all.

USP's Higrade muriate of potash is free-flowing and non-caking and has the highest K_2O content—62/63% K_2O. Also available, USP's Granular muriate of potash contains a minimum of 60% K_2O.

UNITED STATES POTASH COMPANY
DIVISION OF UNITED STATES BORAX & CHEMICAL CORPORATION
30 Rockefeller Plaza, New York 20, New York. Southern Sales Office: Rhodes-Haverty Building, Atlanta, Georgia.

REG. U. S. PAT. OFF.

Important new pest control dedicated to



Artist's conception of Shell Development Company's expanded new Agricultural Research Center at Modesto, Calif.

To STRIKE more powerful blows against agriculture's worst enemy, crop-destroying insects, Shell Development Company is consolidating and expanding its research facilities at Modesto, California.

Upon completion in the fall of 1957, this agricultural research center will rank among the best equipped and most extensive privately maintained laboratories in the world. A staff of more than 100 will explore every aspect of pesticide research. The new laboratories will be composed of three specialized divisions: Biological Research, Chemical Research, and Product Application.

The research facilities also include a well-established 142-acre experimental farm on which major economic

research center
progress in agriculture

crops are grown. This enables Shell researchers to conduct preliminary field tests for the development of new pesticides under actual farming conditions.

Successful pesticides now available from Shell Chemical Corporation include aldrin, dieldrin, endrin, Phosdrin* insecticides; allyl alcohol weed seed killer; D-D® and Nemagon* soil fumigants. With the addition of the Modesto center, Shell looks forward to the development of better pesticides for even more effective control.

This is one of many ways that Shell Chemical Corporation is helping to build a better tomorrow for agriculture and industry through chemical research today. *Shell Chemical Trademark

SHELL CHEMICAL CORPORATION

AGRICULTURAL CHEMICAL SALES DIVISION
460 Park Avenue, New York 22, New York

SHELL

Carteret A.A.C. Co. Plant
at Carteret, New Jersey

Another source of AA quality products

To meet your "quick" or "long term" requirements for a variety of chemicals, depend on the A.A.C. Co. You can count on uniform quality and guaranteed purity through rigid laboratory control. You'll get expert assistance from skilled research people in developing "specials" for unusual projects. And you can count on prompt service.

CHOOSE FROM THESE AA QUALITY® PRODUCTS FOR FARM AND INDUSTRY

Florida Phosphate Rock • Superphosphate • AA QUALITY Ground Phosphate Rock
All grades of Complete Fertilizers • Gelatin
Bone Products • Fluosilicates • Ammonium Carbonate • Sulphuric Acid
Phosphoric Acid and Phosphates
Phosphorus and Compounds of Phosphorus

THE American Agricultural Chemical Co.

GENERAL OFFICES: 50 CHURCH STREET, NEW YORK 7, N. Y.

OTHER A.A.C. CO. SALES AND SERVICE POINTS

Alexandria, Virginia
Baltimore, Maryland
Buffalo, New York
Cairo, Ohio
Carteret, New Jersey
Charleston, South Carolina
Cincinnati, Ohio
Cleveland, Ohio
Columbia, South Carolina
Detroit, Michigan
E. St. Louis, Illinois
Fulton, Illinois
Greensboro, North Carolina
Henderson, North Carolina
Humboldt, Iowa
Havana, Cuba
Montgomery, Alabama
Norfolk, Virginia
No. Weymouth, Massachusetts
Pensacola, Florida
Pierce, Florida
Saginaw, Michigan
Savannah, Georgia
Spartanburg, South Carolina
Three Rivers, New York
Washington Court House, Ohio

Agricultural Chemicals Ltd.
Fort Chambly, Quebec
London, Ontario
Port Hope, Ontario

HEALTHY SOIL . . .
HEALTHY PROFITS!

DUVAL

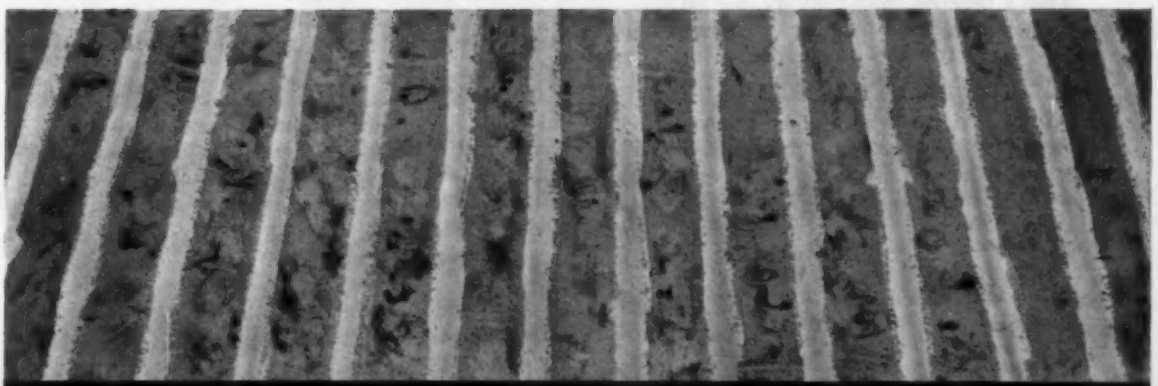
HIGH GRADE MURIATE OF POTASH

Duval Muriate of Potash—A vital element at low cost for healthy soil and healthy profits.

• HIGH ANALYSIS • DEPENDABLE SUPPLY • UNSURPASSED SERVICE

DUVAL SULPHUR and POTASH COMPANY

MODERN PLANT AND REFINERY AT CARLSBAD, NEW MEXICO



ASHCRAFT-WILKINSON COMPANY

Address communications to:

Exclusive Distributors

Atlanta, Georgia • Cable Address: Ashcraft

NORFOLK, VA. • CHARLESTON, S.C. • TAMPA, FLA. • JACKSON, MISS. • COLUMBUS, OHIO • MONTGOMERY, ALA. • DES MOINES, IOWA

RECOGNIZED SAFETY

Miller Bill Rules Out *Harmful* Residues In the Control of Truck Crop Insects

TODAY harmful insecticidal residues on garden and truck crops are strictly taboo. Yet under recent federal legislation, popularly known as the Miller Bill, technical *piperonyl butoxide* and *pyrethrins* are among the few toxic agents to receive official exemptions from tolerances.

That's because their toxicity, for all practical purposes, is limited to insects. In combination these two active ingredients form the versatile, time-tested Pyrenone* concentrates.

When used according to directions, Pyrenone formulations may be used on growing crops *right up to the time of harvest.* They not only leave no harmful residues – but they have no effect on the taste or flavor of treated foodstuffs.

Other exemptions with respect to growing crops include *rotenone* . . . combinations of *piperonyl butoxide, pyrethrins* and *rotenone* . . . combinations of *piperonyl cyclonene* and *pyrethrins* . . . and combinations of *piperonyl cyclonene, pyrethrins* and *rotenone.* All of these compounds are compatible with sulfur, basic copper sulfate and many commonly used fungicides.

To avoid penalties under the Miller Bill, dust garden and truck crops with one or more of the pesticides listed above. Or simply use Pyrenone – and play safe from harvest to market!

*Reg. U. S. Pat. Off., FMC.

Pyrenone

FAIRFIELD CHEMICALS

Fairfield Chemical Division, Food Machinery and Chemical Corporation

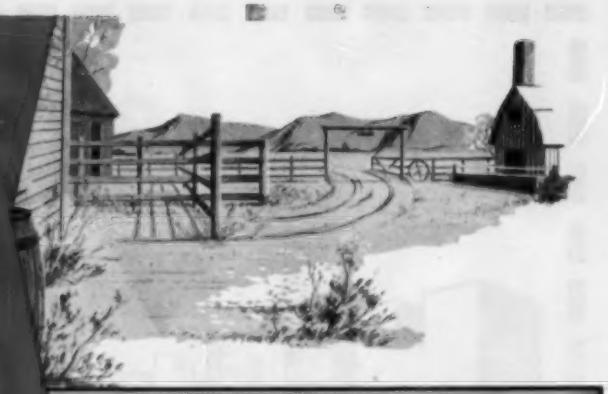
Sales Headquarters: 441 Lexington Avenue, New York 17, N. Y.

Branches in Principal Cities — In Canada: Natural Products Corporation, Toronto and Montreal

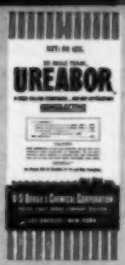
fmc

OTHER FMC CHEMICAL DIVISIONS: WESTVACO CHLOR-ALKALI *Alkalis, Chlorinated Chemicals, Carbon Bisulfide* • WESTVACO MINERAL PRODUCTS *Phosphates, Barium and Magnesium Chemicals* • BECCO CHEMICAL *Peroxygen Chemicals* • NIAGARA CHEMICAL *Insecticides, Fungicides and Industrial Sulphur* • OHIO-APEX *Plasticizers and Resins* • FMC ORGANIC CHEMICALS

4 easy ways to destroy weeds



1



UREABOR®

Nonselective. A granular complex of sodium borate and substituted urea... dust-free...for DRY application. Low rates of application are a big feature.

The PCB Spreader applies the low rates to best advantage and is available for $10.75 delivered anywhere in U.S.A.

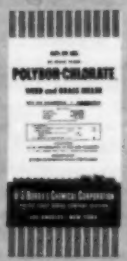
2

DB® Granular

A scientifically balanced formulation of 2,4-D and sodium borates... for DRY application. Kills deep-rooted noxious weeds—perennials and annuals—effectively and economically. The recommended low rates can be applied best with the special hand operated PCB Spreader.

(Not intended for control of grass)

3



POLYBOR-CHLORATE®

A highly soluble powder for spray or dry application. Its double action quickly destroys vegetation on contact and through root absorption. Provides long residual effects. This is a general nonselective herbicide for controlling all types of vegetation.

4

Concentrated BORASCU®

A granular concentrated sodium borate ore for nonselective control of weeds and grasses. It is easily applied, by hand or with mechanical spreaders, in its dry form. Long residual action is a feature—may prevent regrowth for a year or more.

Whether you are concerned with Agriculture or with Industry... you need **BORATE WEED KILLERS**

Weeds incur danger and great economic losses... they steal from crops... they constitute a fire hazard without equal. Nonselective BORATE weed killers attack this menace most effectively by destroying roots and rhizomes and preventing regrowth for long periods. During our lengthy experience with borates for weed control, we have developed special weed killers capable of destroying all types of weeds and grasses under the many various local and regional conditions.

YOU GET ALL THESE FEATURES:

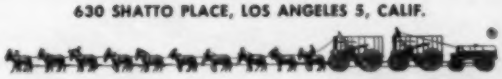
- **NONSELECTIVE HERBICIDAL ACTION**
- **RESULTS THAT ARE LONG-LASTING**
- **EASY APPLICATION AND CONVENIENCE**
- **EFFICIENCY AND ECONOMY**
- **SAFETY—Nonpoisonous, Non fire-hazardous**
- **WON'T CORRODE ferrous metals**

AGRICULTURAL SALES DEPARTMENT

United States Borax & Chemical Corporation

PACIFIC COAST BORAX COMPANY DIVISION

630 SHATTO PLACE, LOS ANGELES 5, CALIF.



mail this coupon

UNITED STATES BORAX & CHEMICAL CORPORATION DEPT. AC
Pacific Coast Borax Co. Div., 630 Shatto Place, Los Angeles 5, Calif.

Please send literature on the following products:

☐ UREABOR® ☐ DB® Granular

☐ POLYBOR-CHLORATE® ☐ Concentrated BORASCU®

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE___ STATE_____

MURIATE
OF POTASH
for the
PLANT FOOD INDUSTRY

THIS symbol stands for high-grade coarse and uniform Muriate of Potash (60% K_2O minimum). Southwest Potash Corporation provides a dependable supply of HIGH-K* Muriate for the plant food industry.

*Trade Mark

Southwest Potash
Corporation

61 BROADWAY • NEW YORK 6, N. Y.

LETTERS TO THE EDITOR

(From Page 6)

tion which would assist in my present problem.

May I express my appreciation of your excellent magazine. I trust I may hear from you at your earliest convenience.

Wilford H. Harris
CORNWALL CANNING CO.
Taber, Alberta, Canada

The following reply is sent by H. H. Golz of American Cyanamid Co.

Dear Mr. Harris:

Your recent letter, concerning the toxicity of malathion, which was addressed to AGRICULTURAL CHEMICALS, has been referred to this office. As you may know, we are the sole manufacturers of malathion and have studied it very extensively.

Malathion is the common name for the diethyl succinate of O,O-dimethyl dithiophosphoric acid. The technical material which we sell to formulators has a purity of 98% or better. Formulators dilute it with various substances commonly employed in the insecticide industry, such as inert dusts and fillers, organic solvents, emulsifiers, etc.

Malathion belongs to a group of substances known as the phosphate ester insecticides. The toxicological effect of all members of this group is qualitatively the same although they differ markedly quantitatively. Thus malathion is by far the safest of the group — it is so safe that the U. S. Department of Agriculture has approved it for use in and around homes and food processing plants, on pets and domestic animals, etc. It has been extensively used by airplane application over populated areas and the entire state of Florida has been blanketed by it quite a few times since last summer in an attempt to eradicate the Mediterranean fruitfly.

When the phosphate ester insecticides produce poisoning in man, the illness is short in duration (24-48 hours) and there are no after effects. These substances have been comprehensively studied by various government agencies, by universities and by industry. No one has ever been able to demonstrate any tissue damage or chronic effects attributable to them. Insofar as malathion itself is concerned, there are only three cases on record of poisoning in man. Two of these were due to swallowing large quantities of it (one by accident and one by suicidal intent). The third was an industrial case in which the exposure was fantastically great. This is a remarkable safety record in view of the fact that to date more than one hundred million pounds of malathion insecticide formulations have been applied.

When illness results from exposure to the phosphate ester insecticides, it begins within hours or minutes of the exposure. In fact, if more than 6 hours elapses between the exposure and the onset of illness, it is strong evidence that something else is responsible.

If you require more information, please supply us with more detailed data.

H. H. Golz, M.D.
AMERICAN CYANAMID CO.

Pesticide Manufacturers

Igepon T-77

Igepon AP-78

improve your wettable powders with these Antara surfactants:

These Igepon® and Nekal® products are particularly recommended for formulating wettable powders because they ensure fast wetting-out and form stable dispersions. They can easily be dry blended with most herbicides, fungicides, and insecticides.

Nekal BA-75

Fast wetting out in hard or soft water

Nekal BX-78

NEW... Nekal WS-99 is the latest addition to our line of agricultural surfactants. It is a powerful new anionic wetting agent which dissolves in both water and hydrocarbons. Try Nekal WS-99 to increase the wetting speed of difficult formulations.

For specific information on the Antara surfactant that will do the best job for you, call or write our technical service department.

Nekal WS-99

ANTARA gaf

ANTARA® CHEMICALS

A SALES DIVISION OF

GENERAL ANILINE & FILM CORPORATION

435 HUDSON STREET • NEW YORK 14, NEW YORK

SALES OFFICES: New York • Boston • Providence • Philadelphia • Charlotte • Chattanooga • Chicago Portland, Ore. • San Francisco • Los Angeles. IN CANADA: Chemical Developments of Canada, Ltd., Montreal

Igepon and Nekal products manufactured by General Aniline & Film Corp. are sold outside the United States under the trademarks "Fenopon" and "Antara-Humifen," respectively

INDUSTRY MEETING CALENDAR

April 2 — Western Agricultural Chemicals Association, spring meeting, Hotel Biltmore, Los Angeles.

April 14-15 — California Fertilizer Conference, fifth annual meeting, Fresno State College, Fresno, Calif.

May 13-15 — Carolinas-Virginia Pesticide Formulators Association, Cavalier Hotel, Virginia Beach, Virginia.

May 20-22 — Chemical Specialties Manufacturers Association, Drake Hotel, Chicago

June 9-12 — National Plant Food Institute, The Greenbrier, White Sulphur Springs, W. Virginia

June 17-19 — Association of Southern Feed and Fertilizer Control Officials, 15th annual convention, Dinkler-Tutwiler Hotel, Birmingham, Alabama.

June 26-28 — American Society of Agricultural Engineers, Michigan State University, East Lansing, Mich.

June 25-28 — Pacific Branch, ESA, Portland, Ore.

July 17-19—Southwestern Fertilizer Conference and Grade Hearing, Galvez Hotel, Galveston, Texas.

Sept. 8-15 — International Congress of Crop Protection, fourth international meeting, Hamburg, Germany.

Oct. 2-4—Beltwide Cotton Mechanization Conference, Shreveport, La.

Oct. 19-21—Entomological Society of Canada, and Entomological Society of Alberta, Lethbridge, Alta., Canada.

Nov. 3-5—California Fertilizer Association, St. Francis Hotel, San Francisco, Calif.

Dec. 2-5—Entomological Society of America, Hotel Peabody, Memphis, Tenn.

Dec. 9-12 — Chemical Specialties Manufacturers Association, Hollywood Beach Hotel, Hollywood, Fla.

Dec. 9-12—Vegetable Growers Association of America, Jung Hotel, New Orleans.

Dec. 11-13—Agricultural Ammonia Institute, Hotel Marion, Little Rock, Ark.

Dec. 12-13—Cotton Insect Control Conference, Peabody Hotel, Memphis, Tenn.

Jan. 13-15—1958 Weed Society of America and Southern Weed Conference, Peabody Hotel, Memphis, Tenn.

Jan. 21-23 — 1958 California Weed Conference, San Jose, Calif.

TRADE LISTING

National Agricultural Chemicals Association, Association Building, 1145 19th St., N.W., Washington, D. C. Lea Hitchner, executive secretary.

National Plant Food Institute, 1700 K St., N. W., Washington, D. C. Paul Truitt and Russell Coleman executive vice-presidents.

American Phytopathological Society, S. E. A. McCallan, secretary, Boyce Thompson Institute, Yonkers, N. Y.

American Chemical Society, 1155 16th St., N. W., Washington, D. C.

Association of Official Agricultural Chemists, P. O. Box 540, Benjamin Franklin Station, Washington, D. C., William Horwitz, secretary-treasurer.

Agricultural Ammonia Institute, Hotel Claridge, Room 305, Memphis, Tenn., Jack Criswell, executive vice president.

American Society of Agricultural Engineers, F. B. Lanham, secretary, 505 Pleasant St., St. Joseph, Mo.

(Continued on Page 117)

superior grinding equipment since 1891

BRADLEY PNEUMATIC HERCULES MILL

Provides a uniform grind from 20 to 325 mesh. Floor level installation provides easy accessibility . . . lowest installation and maintenance costs. Durable, non-clogging vibratory feeder for dependable, worry-free operation . . . even on material with some amount of moisture.

for Fine grinding of limestone phosphate rocks, etc.

for Semi-fine grinding of agricultural limestone

BRADLEY HERCULES MILL

From rough to finish in one low-cost operation. Automatic electric feed control eliminates manual operation. Rugged, dustless construction, maximum accessibility, keep maintenance costs at an absolute minimum. In sizes to meet any requirements at moderate cost.

For complete information, write for catalogs No. 61-62

Bradley PULVERIZER CO.

LONDON ALLENTOWN, PENNA. BOSTON

AMMONIUM NITRATE 33.5%

ANHYDROUS AMMONIA

AMMONIATING SOLUTIONS

Always on Track with STEAMBOAT BRAND

You can depend on getting STEAMBOAT BRAND nitrogen products by rail or truck when you want them.

And you can depend on STEAMBOAT BRAND for the utmost in quality and uniformity. A Bradley & Baker representative will gladly help you plan your shipments. Technical assistance is available upon request for your manufacturing problems.

STEAMBOAT BRAND AMMONIUM NITRATE 33.5% N assures prills; all lines have been removed for uniformity and better mechanical condition; packed in attractive polyethylene-lined multiwall paper bags.

STEAMBOAT BRAND AMMONIUM NITRATE SOLUTIONS—to meet every specification of fertilizer manufacturers; both ammonium nitrate and ammonium nitrate-urea types.

STEAMBOAT BRAND ANHYDROUS AMMONIA—high quality maintained even at times of highest demand.

MISSISSIPPI RIVER CHEMICAL COMPANY

A Division of Mississippi River Fuel Corp., St. Louis, Mo.

Sales agents: BRADLEY & BAKER • 155 EAST 44th STREET • NEW YORK 17, N. Y.

District Sales Offices: ATLANTA • INDIANAPOLIS • ST. LOUIS • NORFOLK • HOUSTON

When we checked International's

"How to get an extra 212 lbs. of nitrogen solution in each ton of triple"

says Mr. W. R. Edgecomb, Treasurer and General Manager of the Aroostook Hi-Test Fertilizer Company, Presque Isle, Maine

With International's triple we use 666 lbs. of nitrogen solution* per ton, reports Edgecomb. With another triple, our ammoniation rate was only 454 lbs. of solution per ton.

*24.5% free NH_3; 56.0% Ammonium Nitrate; 10.0% Urea; 9.5% H_2O.

A calibrated measuring tank is the heart of Hi-Test's batch ammoniating system. Triple is ammoniated as it is unloaded from rail cars.

Superior ammoniation qualities make International's triple ideal for high analysis fertilizers. Complete ammoniation reduces chance of setting up.

The Hi-Test plant mixes four grades of high analysis fertilizers . . . all sold under the Hi-Test brand name. 80-pound bags are moved by conveyor.

ammoniation rate, we learned

Superior ammoniation qualities are important reasons why Mr. W. R. Edgecomb (left) and Mr. Harry W. Trask, Sales Manager, are satisfied users of International's triple super.

"WE LEARNED by experience. Our ammoniation rate proved that International's triple had the superior ammoniation qualities we were looking for," says W. R. Edgecomb, of the Aroostook Hi-Test Fertilizer Company.

"We ammoniate 1500 pounds of International's triple with 500 pounds of nitrogen solution. This gives us a base of 11.1% nitrogen and 35.2% A.P.A."

Compare these results with the ammoniation rate for the triple they previously used — 370 pounds of solution for each 1630 pounds of triple. It's easy to see why International's triple helps this Presque Isle, Maine, firm hold down formulation costs . . . why they are really sold on International.

From the time they receive the triple at their plant siding . . . this highly efficient fertilizer plant operates to take full advantage of the many savings offered by International.

First of all, water shipments to Searsport, Maine, help hold down the cost of the delivered goods. The triple is then shipped by rail to Presque Isle.

Then Aroostook ammoniates the triple from the track. The triple passes through a batch ammoniating system featuring a calibrated measuring tank.

This ammoniating procedure, says Edgecomb, gives them superior results and reduces the possibility of the ammoniated triple setting up. And in addition it gives the material a more desirable granular texture.

What's more, with International's triple they are able to unload a car of nitrogen solution in 1½ days . . . a saving of a full half day. This in turn helps avoid any extra demurrage charges.

This system enables Hi-Test to handle large shipments of triple during the slack season and save on freight. With four men working, they can ammoniate 90 tons of triple (121 tons of base goods) in a normal working day.

If you have not already tried International's superior product — the triple with a guaranteed constant minimum of 46% A.P.A. — put us to the test. You too will become a satisfied customer.

Write or wire International Minerals & Chemical Corporation for full information on prices, shipping and warehousing arrangements.

PHOSPHATE

CHEMICALS

DIVISION

MINERALS International CHEMICALS

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

General Offices: 20 North Wacker Drive, Chicago 6

Granulating is fireproof with Du Pont URAMON® Ammonia Liquors

Du Pont "Uramon" Ammonia Liquors give you maximum safety in high-temperature granulating by eliminating dangerous flash fires in the mixer; and, further, by assuring safety in the pile.

Fireproof conditions are maintained in the mixer when Du Pont UAL is used. As the ammoniation proceeds, the ammonium carbamate in UAL changes to ammonia and carbon dioxide. Ammonia enters the reaction and carbon dioxide displaces the air, thus creating conditions that guard against combustion.

Four formulations are available . . . all are equally safe for granulating. For technical assistance and information on the solution best suited to your use, write Du Pont.

HERE ARE OTHER IMPORTANT ADVANTAGES OF DU PONT URAMON® AMMONIA LIQUORS:

- High-quality nitrogen from UAL resists leaching . . . supplies both urea and ammonium forms of nitrogen.
- Won't corrode regular fertilizer manufacturing equipment, including ordinary steel and aluminum.
- Gives mixed goods better "feel"—minimizes caking, segregation and dusting.
- Suitable for either batch or continuous mixing.
- Prompt, dependable delivery enables you to schedule your production with confidence.

DU PONT
REG. U.S. PAT. OFF.

URAMON®
AMMONIA LIQUORS

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

E. I. DU PONT DE NEMOURS & CO. (INC.)
Polychemicals Department • Wilmington 98, Delaware
1616 Walnut Street, Philadelphia 3, Pa. — 7250 N. Cicero Ave., Chicago 30, Ill.
Du Pont Company of Canada (1956) Limited
85 Eglinton Avenue East, Toronto, Canada

ALL THESE FLY SPRAYS CONTAIN

Fly Repellent

The biggest money-maker for you is the fly spray that pays off best for dairymen and livestock farmers. CRAG Fly Repellent, used in formulation with an insecticide, gives you two sales-building advantages.

1. The repelling action of CRAG Fly Repellent keeps biting, blood-sucking flies, as well as gnats and mosquitoes, from bothering livestock. The animals graze more and produce better. The result is bigger milk checks and more beef on the hoof for farmers—better sales for you.

2. By extending and improving the effectiveness of insecticides, CRAG Fly Repellent makes sprays last longer, work better. This double action of CRAG Fly Repellent helps you build the customer loyalty that means repeat sales.

Dairy cattle sprays containing CRAG Fly Repellent, along with insecticides, are recommended in leading dairy states. CRAG Fly Repellent pays off with beef cattle, too. Formulations containing CRAG Fly Repellent are ideal for treadle sprayers and back-rubbers.

CRAG BRAND AGRICULTURAL CHEMICALS

MAIL THIS COUPON NOW

"Crag" is a registered trade-mark of Union Carbide and Carbon Corporation

CARBIDE AND CARBON CHEMICALS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, New York

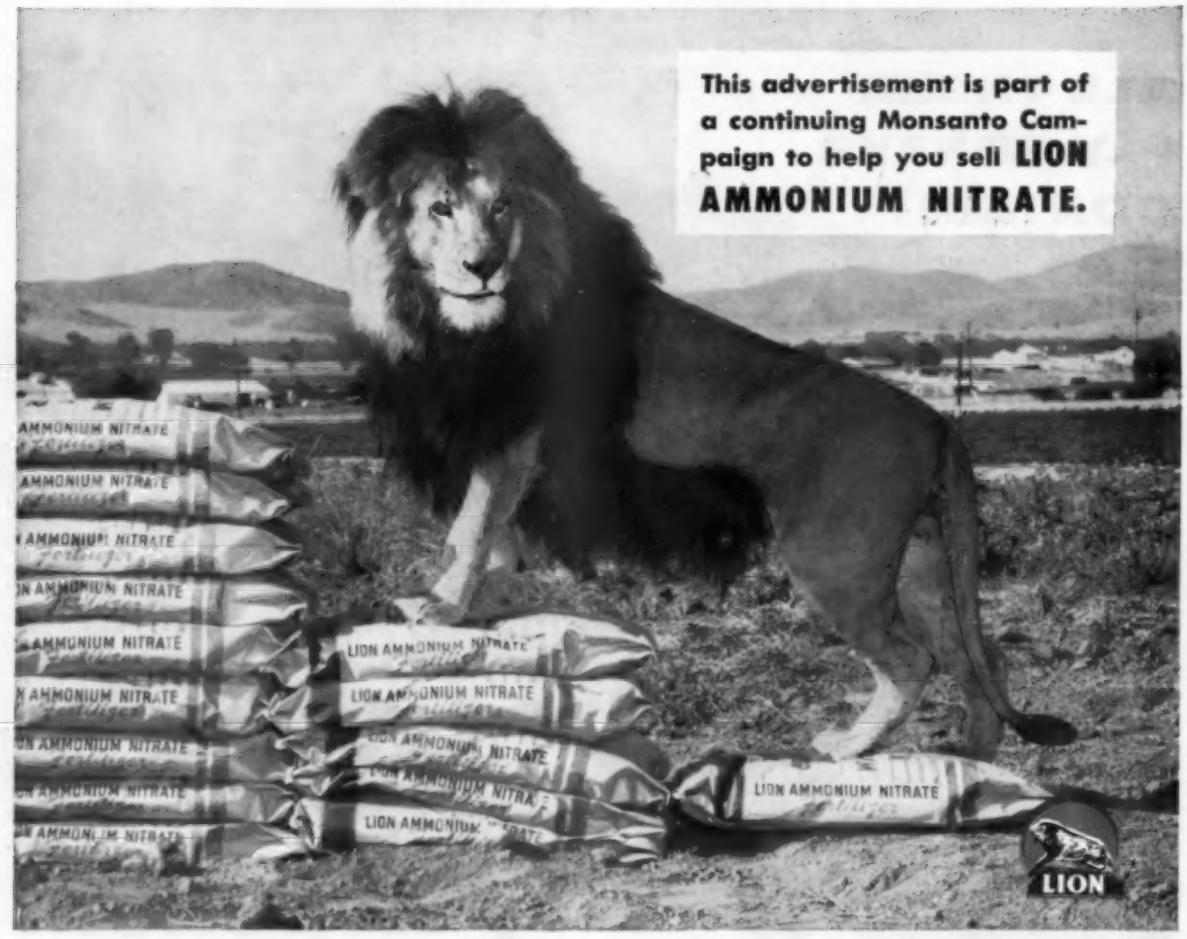
Please send me full information on the formulation of fly sprays with CRAG Fly Repellent.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____


This advertisement is part of a continuing Monsanto Campaign to help you sell LION AMMONIUM NITRATE.
LION AMMONIUM NITRATE
LION

*Trade-mark of Monsanto Chemical Company

You get bigger yields with LION in your fields

LION BRAND AMMONIUM NITRATE IS GUARANTEED TO FLOW FREELY

FOR MORE PRODUCTION, Lion Ammonium Nitrate contains TWO kinds of plant nitrogen. *Quick-acting* nitrate nitrogen that gets crops started fast... and *long-lasting* ammonia nitrogen that resists leaching and feeds your crops steadily during the important growing months that follow.

FOR EASIER SPREADING, Lion Ammonium Nitrate is in pellet form. These pellets are specially coated to withstand caking... then packed in specially lined, moisture-resistant bags. Result: LION brand is *guaranteed* to flow freely—*not for just a year, but until used*—when you follow storage directions on the bag.

3 EASY STEPS TO GET *ALL* THE FEEDING-POWER YOUR CROPS NEED

1. TEST YOUR SOIL to see what kinds and amounts of fertilizers are needed. Your local farm authorities will help.

2. ORDER WHAT YOU NEED of mixed fertilizer and Lion brand Ammonium Nitrate from your fertilizer dealer. When you buy LION, you get top-quality, low-cost nitrogen fertilizer *guaranteed* to flow freely; *guaranteed* to contain 33.5% nitrogen.

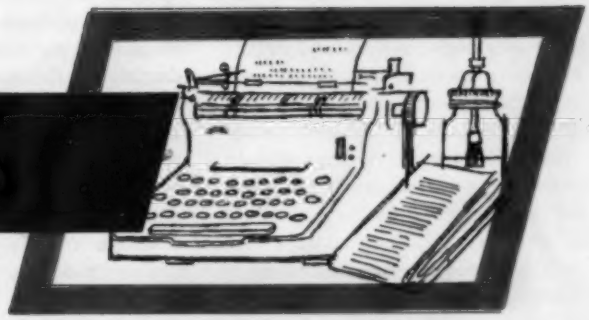
3. APPLY THE FULL AMOUNT of mixed fertilizer and Lion brand Ammonium Nitrate soil tests indicate. Don't skimp—fertilizer is the least expensive item you use for crop production.

GROW MORE PROFITABLY...
Weed Killers • Brush Killers • Parathion Insecticides • Meta-Green® to keep silage fresh • Phosphates (liquid and solid) • LION Sulphate of Ammonia • Anhydrous Ammonia

MONSANTO

MONSANTO CHEMICAL COMPANY • Inorganic Chemicals Division, St. Louis 1, Mo.

EDITORIALS



THE agricultural chemical industry currently has a "hot" new product to promote as the 1957 season gets under way. We refer of course to gibberellic acid for which some very interesting claims are being made as a growth stimulant for flowers, ornamentals, truck crops, etc.

Publicity on the new material is breaking all over the place, several producers are in the usual race to see who can get to market first, and sales in the horticultural field over the early months of the '57 season figure to be brisk in view of the novelty of and the interest shown in this potentially very promising new specialty product.

In the calm before the storm the industry might well pause to contemplate some of the mistakes made in marketing earlier "wonder products," and perhaps to resolve that similar mistakes should not be allowed to plague this product, — that it shall have a fair chance to prove itself and not be damned in advance by the marketing errors and excessive and over-optimistic claims that have created user dissatisfaction with similar products in the past.

Perhaps it is just as well that it will take at least six months to get together the necessary chronic toxicity data before gibberellic acid can be released for use in the agricultural field. Thus there will necessarily be a cooling-off period between the mild hysteria that is common in the horticultural field and the more sober approach which should precede release of this promising new material to agriculturalists.

But, to return to our thoughts on what should be guarded against to insure GA having a fair chance to prove itself, first and foremost, we would suggest that the phrase "miracle product" be forgotten. Conditioning the user to expect miracles is the surest way of guaranteeing dissatisfaction with subsequent performance. It would be refreshing if for once a product could be undersold rather than oversold.

Second, let's not rush the product or formulations onto the market before they are really ready. And by "ready" we mean with enough experimental work done so that experts in the field whose opinions will eventually make or break the product can have access to performance records on a long series of plants or crops, under varying soil, geographic and climatic conditions.

Third, let's decide, on the basis of factual data, whether this is a material that is actually economic for the commercial grower, or whether it is a product that because of cost will go no further than the potted plant or the home garden market.

Fourth, let's see that it reaches the market through the medium of the professionals, the agricultural chemical formulators whose brand names mean much to themselves and to the public, and who can be depended upon to market legitimate products. They are the dependable factors in this industry. They expect to be in business next season as well as this season,— and can be counted on to supply products containing a sufficient amount of the active ingredient to actually give it a chance to perform.

Incidentally, we are happy to report that the first commercial producer of gibberellic acid is committed to exactly this type of marketing program. They will sell exclusively through

(*Continued on Page* 122)

Gibberellic Acid

A Potential Agricultural Chemical

INCREASING interest in the growth stimulant, gibberellic acid, prompts this review of the properties, plant response and production of this new product. The material is currently being produced in sufficient quantities for extensive experimental use* and it is reported that production on a commercial scale is feasible as the need develops.

The history of the discovery, isolation, and tentative chemical identification of gibberellic acid was described in detail by F. H. Stodola at a meeting of the American Institute of Biological Sciences at Storrs, Conn., in August, 1956. The purpose here is not to review the history of this development — although it is an interesting one—but rather to discuss some of the recently reported effects of gibberellic acid and, on the basis of these, to speculate on the potential applications this interesting new product may find in practical agriculture and horticulture.

Before reviewing the specific effects of gibberellic acid on plant growth, it is interesting to look at some of the general properties as they relate to use on plants. The material is soluble in ethanol, acetone, and water in amounts greatly in excess of those required to influence plant growth. It is quite stable in organic solvents, and stable in water for at least short periods. Stability in water is not affected by pH over a wide range. In view of these characteristics, formulation of gibberellic acid for plant application presents no serious problem.

Gibberellic acid is readily absorbed by intact plants, regardless of the site of administration. It is taken through the roots from nutrient solutions. It is absorbed with apparently equal readiness through the epidermis of stems or leaves, on both young and mature plant parts, from either alcoholic or aqueous solutions, or from lanolin suspensions. It is taken by germinating seeds from simple admixtures with talc or other inert carriers dusted onto the dry seed.

There is good evidence that gibberellic acid is highly mobile within the plant, often producing responses at points considerably removed from the site of application. Thus, placment of a drop of gibberellic acid solution at the apex of a plant results, within a few hours, in elongation of stem internodes well below the tip. Conversely, the effect of an application at the base of the stem is expressed as increased elongation of internodes above the treated area.

The characteristic plant responses to gibberellic acid are elicited by extremely low dosages, and often appear within hours after treatment. Dosages of less than one microgram per plant may produce visible effects. On the other hand, dosages of 100 micrograms or even more have essentially the same initial effect as the lower rate, but effects persist over a longer span of time.

The possible toxicity of very high concentrations of gibberellic acid has not been investigated to any great extent. This is not too surprising in view of the limited (until very recently) supply of gibberellic acid, coupled with the fact that so many striking effects are produced at very low application rates. However, where topical applications of this material have been made, relatively high concentrations have been used without visible damage. British workers have reported applying drops of alcoholic gibberellic acid solution containing as much as 500 ppm, and mention no local toxicity. In studies at the Battelle Memorial Institute, lanolin suspensions containing as much as 5000 ppm gibberellic acid have been applied topically to leaves and stems of soybeans, with negligible local damage. It is certainly to be expected

*Some of the current manufacturers and suppliers of gibberellic acid are: Merck & Co., Rahway, N. J.; S. P. Penick & Co., New York; Eli Lilly Co., Indianapolis, Ind.; Chas. Pfizer Co., Brooklyn; and Abbott Laboratories, Chicago.

Presented on the technical program of the ninth National Chemical Exposition, Cleveland, November, 1956.

that so active a material as gibberellic acid would produce some harmful effects on plant growth at high dosage levels. However, present evidence is that there is a very wide spread between rates required to give useful plant growth responses and those necessary to produce toxicity.

Summarizing the more important properties of gibberellic acid, from an applications viewpoint: It has good solubility in solvents acceptable for plant application; it is readily absorbed by intact plant parts; it has a high degree of mobility within the plant; it produces growth responses at low dosage rates; and it is non-toxic at levels well above those required to influence plant growth. These properties, considered in the light of the growth regulatory characteristics to be discussed next, add up to an attractive picture as regards the potential usefulness of gibberellic acid in agriculture.

Here are the more striking effects of gibberellic acid on plant growth which have been reported:

On intact plants: Gibberellic acid promotes the elongation of stems, petioles and, to a lesser degree, leaf blades. The elongation is primarily due to linear extension of cells, rather than to increased cell division. Stem diameter is not markedly affected.

When applied to young plants, gibberellic acid may produce marked increases in both fresh and dry weight, the effect being greater on the above-ground portion of the plant than on the roots. A large proportion of the increase can be accounted for on the basis of increased carbon assimilation, although there is some increase in the plant ash as well.

The total soluble carbohydrate and particularly the glucose fraction, was found to be increased in young wheat and pea plants supplied with gibberellic acid in the nutrient solution.

Gibberellic acid substitutes for the exposure to red light required for germination of lettuce seed.

In at least some biennial plants—which require a cold period between the vegetable growing phase and the flowering phase—gibberellic acid induces stalk formation and flowering in the absence of the cold period.

Gibberellic acid hastens the germination of certain seeds, and increases the amylase content of the germinating seeds. Emergence of seedlings is also hastened by gibberellic acid treatment of the seeds before planting.

Flowering of plants may be hastened or retarded, depending on the species involved and perhaps on other factors as well.

Dormancy of freshly dug Irish potatoes can be overcome by soaking in a solution of gibberellic acid.

A few other interesting effects have been found in treatment of excised plant parts:

Water uptake and respiration are both increased in excised stem sections exposed to gibberellic acid.

Gibberellic acid applied to the cut end of decapitated plants stimulates development of the lateral buds.

It is evident from this listing that gibberellic acid influences many apparently dissimilar plant growth processes. Quite possibly it affects some basic reaction common to all the processes involved, but at present it is not clear what this may be, and a great deal of fundamental work will be required to find out. Meanwhile, what are the potentialities for immediate practical use for gibberellic acid?

One evident possibility is that gibberellic acid can increase crop yield. Dry matter increases reported to date have all been obtained on young plants. It remains to be established whether these weight gains, representing an increase in carbon assimilation, can carry through to crop maturity, or be secured by applications of gibberellic acid late in the growing cycle. Certainly not all crops can be expected to respond, but it seems safe to predict that production gains in certain crops will eventually be possible from the use of gibberellic acid.

The simple effect of gibberellic acid in increasing stem elongation seems to hold considerable promise. USDA workers have already reported striking increases in linear growth of young forest trees, though not in all species studied. This could lead to improvement of both yield and fiber quality of trees grown for pulpwood. Similarly, herbaceous fiber crops, flax for example, might be improved by properly timed use of gibberellic acid.

The reported effects of gibberellic acid on flowering, especially in stimulating flowering of biennials without interposition of a cold period, are particularly interesting. With certain crops—sugar beets, for example—which are biennial in habit, seed production requires two growing seasons. The plants grow vegetatively the first year and the roots must be held over winter, either in the ground or in storage. Flowering and seed production occur the second year. An obvious saving in time and increase in efficiency of land use would result if the crop could be made to produce seed during the year in which it is planted. Gibberellic acid may be the answer.

Possible value can also be seen in the reported hastening of flowering of certain species, from treatment with gibberellic acid. Crops responding in this manner may be brought to maturity in a shorter growing period, thus extending their geographic range in instances where length of growing season is a limiting factor.

These are speculations only at this time. Whether they become practical realities, or whether other and as yet unforseen applications of gibberellic acid turn out to be the important ones, remains to be seen. In any event, it is pretty certain that gibberellic acid will continue to make the headlines in agricultural research.★★

by H. T. Kemp, R. G. Fuller and R. S. Davidson
Battelle Memorial Institute
Columbus, Ohio

Foliage Fungicides

TREMENDOUS progress has been made in recent years in the control of plant diseases by chemical means. This phenomenal progress has occurred through the cooperative efforts of plant pathologists, plant physiologists, microbiologists, chemists, and mechanical engineers. Perhaps gone forever is the day when one person can rightfully be credited as the sole inventor or discoverer of a fungicide.

In the lifetime of the present generation, the development and commercial adoption of such tremendously important organic fungicides as the dithiocarbamates (Tisdale, Heuberger and Horsfall and the DuPont and Rohm & Haas organizations), quinones (TerHorst and U. S. Rubber), phthalimide (Daines and Standard Oil chemists), imidazolines (Wellman and McCallan and Carbide & Carbon chemists), phenyl mercury compounds (Howard and Gallowhur), and phenyl crotonate, (Rohm & Haas), have occurred. In addition a number of prospective fungicides still classed as experimental are available for testing. An indication of the large number of new materials currently being tested is found in data kindly supplied by Fink and Zeiders of Pennsylvania State University. In their tests 15 new fungicides were tried this year on apples and 6 additional ones on potatoes. An impressive number of antibiotics are also available for use against plant disease-producing organisms.

While this phenomenal progress was taking place, considerable advances have occurred in our understanding of fungicidal action, and of molecular configurations, or nuclei, that are active in this action. Commendable though these advancements are, much more work is needed before fungicides possessing their most desirable properties can be produced and before spray combinations can be chosen on a basis other than trial and error.

With the development of these new fungicides, a number of previously uncontrollable plant diseases have been subdued by man and the control of many diseases has been improved by the proper use of these new members of our fungicide arsenal. Perhaps, in so far as eastern apple growers are concerned, the most significant effects resulting from the use of these new organics, are the secondary effects on fruit finish, yields, keep, tree vigor, and the effects on insect and mite populations. In fact, the basis of choice of a fungicide for many eastern orchards has largely shifted from efficiency of control of such omnipresent diseases as apple scab, to a consideration of these secondary effects.

The general improvement in fruit finish from the use of certain of these newer fungicides is well known, but the variation in variety response is perhaps not so well known, for example, the Golden Delicious variety does very well, from a finish standpoint, on a sulfur or captan program. Thiram does well on this variety provided it is not used with lead arsenate, and glyodin does well if not used with lead arsenate or dieldrin. Ferbam, on the other hand, too often produces apples that are almost unsaleable. The finish of Red Delicious apples is usually excellent where a ferbam, glyodin, or captan schedule is used, but on a sulfur schedule this variety frequently develops fruits of poor finish. The foliage of this variety occasionally develops small, circular, injured areas from the use of captan. The tendency for this injury to develop seems to be greater when warm, cloudy periods occur near the blooming period, yet it may occur at almost any time during the growing season. The occurrence and severity of this injury is increased as the quantity of captan deposits are increased. The Stayman variety responds well to the use of captan and usually to glyodin as fungicide sprays. However, the use of sulfur and ferbam frequently results in the development of rough, russetted fruit having a tendency to crack. The finish of Rome beauty or McIntosh fruits seldom exhibits differences as a result of the fungicides used, but the foliage of Rome may show injury from the use of glyodin-lead combinations, or certain of the carbamate sprays.

Data are accumulating to show that increased yields frequently follow the use of the newer spray materials in comparison with old-time schedules. Many reasons for these increases have been ascribed. In 1952, Szkolnik (13) working in New York

TABLE 1
Effects of Fungicide and Insecticide Combinations on Mite Populations
New Jersey—1956

Treatment **	Mites per 100 Leaves * Stayman July 2	Stayman July 12	Red Delicious July 2	Red Delicious July 12
Captan	120	65	85	110
Glyodin	5	0	5	5
Thyolate	5	60	15	10
Sulfur to Bloom, Thyolate P.F., Captan covers	290	400	845	360
Sulfur to Bloom, Thyolate P.F., Glyodin covers	20	10	500	235

* Counts made by Dr. B. F. Driggers.
** Lead Arsenate and DDT used as insecticides. Ovotran used in P. F. and 1st cover.

reported that small tomato plants and apple trees produced an increased root and top growth following a root dip in a captan suspension. Perhaps this has given rise to the speculation by some that captan exerts a hormonal effect on sprayed apple trees. Hilburn of Maine wrote the author that apple foliage sprayed with the newer fungicides has shown increases in chlorophyll content, over a sulfur schedule, by from 15 to 35 per cent. And experiments and observations in

TABLE 2
Sooty Blotch Control Studies—Golden Delicious
New Jersey—1956

Materials Used *	Spray Applied	Fruit Showing Sooty Blotch at Harvest—Oct. 11 Sooty Blotch
Check—Unsprayed after 5th cover		66.6
Zineb 1½#	Aug. 8	17.6
Zineb 1½#	Sept. 5	10.6
Captan 1½#	Aug. 8	20.7
Captan 1½#	Sept. 5	15.4
Captan 1#, Zineb 1#	Aug. 8	13.8
Captan 1#, Zineb 1#	Sept. 5	3.1

*All trees sprayed with captan + lead arsenate at 5th cover.

and

COMBINATION SPRAYS

New Jersey have shown that foliage sprayed with some of the new organics remains on the tree longer (up to 1 month) and is retained in much better condition than where the sulfur-copper schedule of a few years ago is used. Perhaps the increased chlorophyll content and the longer term of effective service to the tree by its foliage under the newer schedules does much to account for the development of larger fruit buds and the resulting crop increases. In New Jersey, many blocks of apples that formerly showed strong biennial tendencies have now produced, on a captan schedule, four good crops in as many years.

Not all yield effects resulting from the use of the organic fungicides are good. In New Jersey and, I understand, in Pennsylvania and Virginia, the phenyl mercuries have reduced yields and this even when reduced concentrations were used.

That glyodin exerts a suppressing effect on mite populations was observed early by Hilburn and others (88) and is now generally accepted. On the other hand, a few sulfur sprays, through the destruction of predators, may seriously complicate the mite control problem. Mites, for some unexplained reason, are frequently a problem on captan-sprayed trees as indicated in Table 1.

Fred Lewis(Penna.) reports by correspondence that glyodin may reduce control of codling moth when used with DDT or DDD.

Fungicide Mixtures

As good as some of the fungicides are, there is no fungicide that is best, or even acceptable under all circumstances. For example, captan is excellent against several of the major apple disease problems, but it fails miserably against powdery mildew of apples; it provides limited protection against cedar rust and will control sooty blotch only where frequent sprays are applied. To give it a sufficiently wide spectrum of disease control, mixtures of two or more fungicides used together or in succession at appropriaate places in the spray schedule are necessary. An example, showing the benefits derived from the addition of Zineb to a captan schedule in a critical sooty blotch application is given in Table 2.

Here, from only one year's data, synergistic activity might be suspected.

The value of adding sulfur to captan or glyodin sprays, followed by Karathane in the late covers when powdery mildew of apples is a problem, is shown in Table 3. Neither glyodin nor captan will control this disease.

Glyodin is a relatively mild protective fungicide when used against apple scab, but when mixed with a phenyl mercury, which possesses excellent back action, it becomes an effective choice against this disease. The addition of a phenyl mercurial to captan, ferbam, or sulfur similarly transforms the application from one possessing only mild or no eradicant value to one of pronounced activity. A number of investigators are now testing dichlone as a substitute for the mercurial in the above mixtures in the hope that good eradication activity may be maintained without reducing yields.

In the search for desirable fungicide mixtures to improve disease control, there is always the hope that a combination of fungicides can be found that will possess more desirable properties than one might expect from the performance of each one singly. That one may be found which will act as a safener for the other, as was the case with the cop-

By Robert H. Daines
New Jersey Agricultural Exp. Station
Presented at the American Phytopathological Society, Cincinnati, Ohio, Dec., 1956.

TABLE 3

Studies on the Control of Powdery Mildew on Apples * Virginia 1956

Treatment	Powdery Mildew Infections No/100 leaves	Control
1. Karathane 1#**		97.4
2. Karathane ½#**		95.5
3. Captan, Sulfur (Mag. 70) 3# through 2nd cover, Karathane late covers	5.8	98.1
4. Glyodin (Mag. 70) 3# through 2nd cover, Karathane late covers	8.3	97.3
5. Mag. 70-5#, ferbam 1# through 1st cover, Karathane + ferbam late covers	5.8	98.1
6. Anisomycin 200 to 100 to 50 ppm	12.3	95.9
7. Griseofulvin 100 ppm	248.9	18.0
8. Unsprayed	303.4	0.0

* Data supplied by Dr. A. B. Groves, Virginia.
** Average of several Karathane treatments.

TABLE 4

Effect of Fungicides on Brown Rot Blossom Blight Infection * Pennsylvania—1956

Materials Used **	Brown Rot Cankers per Tree
1. Unsprayed Checks	142.0
2. Phygon ½#	71.4
3. Micronized sulfur	145.2
4. Micr. sulfur 3¼#, Phygon ½#	85.9
5. Thioneb 2#	44.4
6. Captan 2#	89.4

* Data supplied by Dr. F. H. Lewis, Pennsylvania.
** Sprays applied in bloom one day after rain period.

per-zinc-silicates, or any synergize the fungicidal activity of the other, as silver may synergize mercury by increasing the rate of absorption of the mercury ions, is the constant hope of the investigator. If the fungicidal effectiveness or phytocidal properties of the carbamates is related to CS_2 evolution, then nabam or zineb should be rendered more fungicidal or phytocidal by the addition of Thiram or TETD, since such combinations increase carbon disulfide evolution (16) about three fold. On the other hand, Thiram or TETD should have a depressing effect on ziram since the addition of either of these chemicals to ziram decreases carbon disulfide evolution by about one-half. Experiments conducted by the author demonstrated that full doses of captan and sulfur deposited on Red Delicious foliage increased the typical captan leaf-spotting from about 10 per cent of the leaves affected on captan-sprayed-trees to over 60 per cent where the mixture was used. The reason for this tremendous increase in leaf-spotting from the use of the combination is unknown, but speculations may be in order. The known facts concerning sulfur toxicity are that it vaporizes and enters the cell as elemental sulfur and is oxidized to H_2S and leaves the cell as such along with equal moles of CO_2 (9, 10). The mechanism of captan action appears to be that captan hydrolyzes on the leaf surface to produce HCl, H_2S, and other compounds. The HCl produced may in its own right, be sufficient to injure some plants. In addition, captan may be solubilized by certain organic solvents in which form it would enter the cell. Captan reacts readily in solution with sulfhydral amino-containing compounds, resulting in a breakdown of the molecule which destroys the fungicidal capacity of captan as demonstrated by the authors back in March 1954 in spore germination tests using cysteine, glutathione, and the fungicide in question. In the reaction that occurs HCl and H_2S are among the by-products.

It becomes clear then that H_2S may be produced from the toxic action of both captan and sulfur. If the hydrogen donor is the same in each action, or if the resulting hydrogen sulfide produces toxicity, the effects of these two materials used together may exceed that of each used alone.

Confirmed evidence of synergized fungicidal activity by the use of fungicide combinations is unknown to the writer, but data occasionally appear that suggest that the use of combinations either improves or interferes with fungicidal activities.

An example of possible synergized activity is indicated in the sooty blotch control data recorded in Table 2.

In a brown rot control experiment, see Table 4, bloom sprays were applied to peaches one day after a rainy period. Dr. Lewis of Penn State reports that the reduction in phygon efficiency when mixed with sulfur was statistically significant but since sulfur improves the protective value of the spray, the combination seems desirable. Data (Table 5) indicate that mixtures of Tag (phenyl mercury) and Glyodin, sulfur, or fermate provide a shorter period of effective back action against apple scab infections than does Tag when used alone. Again, however, the improved

(*Continued on Page 107*)

TABLE 5

The Relationship between Temperature and the Length of the Infection Period after which Scab Control Can Be Obtained with Eradicant Fungicidal Mixtures on Rome Beauty Foliage* Greenhouse, Geneva, 1954

Treatment	Time After Infection Period Began That Scab Control Was Obtained 45°F.	55°F.	65°F.
	hr.	hr.	hr.
Tag ¼ pt.	96	60—	48—
Tag ¼ pt., Glyodin 1 qt.	72+	48	36
Tag ¼ pt., Micronized sulfur 3#	72	48	36—
Tag ¼ pt., Permate ¾#	48—	36—	24—

* Data supplied by J. M. Hamilton and M. Szkolnik, Geneva, New York.

Pneumatically operated, nine-section cluster hoppers at the new G.L.F. plant have been arranged to feed two production lines from the top floor. The two lines contribute to greater flexibility.

A NEW CONCEPT OF

Plant Layout and Design

By James E. Madigan
Fertilizer Engineering & Equipment Co.

Twin bagging machines, located on the second floor, discharge bags to twin conveyors which carry bagged goods to storage and/or loading dock. There is no equipment on the main floor of the plant.

AN original design, coupled with new approaches to old problems, has, after two seasons of operation, proven to be of great value in the modern granular G.L.F. Fertilizer Plant at Big Flats, New York.

These unique features were incorporated into the architectural and engineering phases of Fertilizer Construction Company, Inc., of Green Bay, Wisconsin, who handled the entire project on a turnkey basis, including supply of all components of equipment by an associated firm.

The concept of a fertilizer plant with no equipment on the main floor is, in itself, almost as revolutionary as a plant with nine high capacity bucket elevators, but not one elevator pit.

Early in the planning stages the advantages of keeping main floor working areas clear of machinery were readily apparent, and in subsequent engineering calculations heavier structural members were designed to carry equipment at various elevations. These considerations paved the way for placing elevator boot sections directly on the first floor, rather than in pits ten feet deep.

The advantages visualized were numerous and significant. Most important of all, freedom of movement of bulk loading equipment has proved a great operating advantage, in addition to the benefits of greater safety.

Regarding elevators, this design eliminated the dusty, hard-to-clean and often crowded elevator pits. Any plant operator who has attempted adjustment and maintenance of elevators in a dark, dirty pit would readily perceive the ease of caring for this vital equipment when it is installed on the main floor.

The main floor of the plant with two elevators (foreground) which feed raw materials to hoppers and mixers. In background, inclined screws are used to feed elevators.

The author, who is president of the Fertilizer and Engineering Co., Green Bay, Wisc., describes the planning and construction of a revolutionary type of fertilizer plant, in which all the equipment is located above the ground floor.

In the final design stages, the raw material bins were located along the end of the building. To facilitate planning, a scale model was built to study the flow and movement of materials. It thus became apparent that the 32 ft. aisleway adjacent to the bins, and directly under the second floor equipment space at the 12 ft. elevation, could be put to optimum use. Dividing bulk-heads were extended 16 ft. into this aisleway, leaving an ample runway of 16 ft. In practice the natural angle of repose allowed material to extend 12-14 ft. into the 16 ft. bin extension, and the opening from the floor up to the 12 ft. floor elevation was not closed up. Immediately, all the problems and headaches associated with removing bulk heads to gain access to bin stored raw material were eliminated.

Specially designed inclined screw conveyors, operating at 45 degree angles and equipped with hoppers designed for payloader charging, were used to feed raw materials from within the plant. These same elevators were used to unload raw materials from cars spotted along the receiving dock.

Overall plant layout involved provisions for unloading, storing raw materials, mixing, granulating, and bulk loading at one end of the plant, and intermediate product storage in bins, which was possible by using FEECO belt trippers. At the other end of the building, bagging and shipping operations are conducted. This greatly reduces traffic problems arising from payloader and truck congestion.

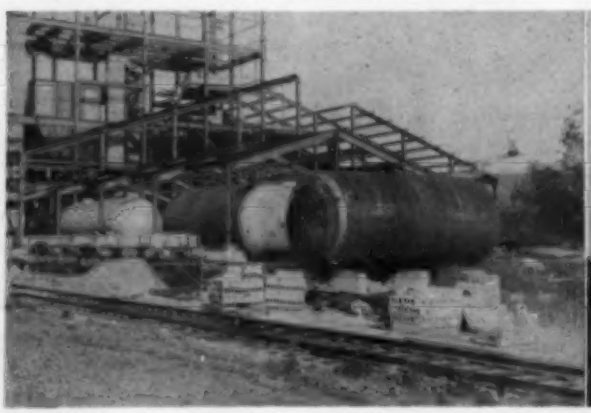
To facilitate direct bagging of granulated goods, ten thousand square feet of bagged goods storage area were made available. In this respect, the equipment furnished by Fertilizer Engineering and Equipment Company, Inc., was designed and installed so that raw materials could be unloading directly from the cars to an overhead, air operated hopper system, through processing and granulation, and directly to the bagger.

After bagging, fertilizer moves on overhead belt conveyors to three loading points or to the bagged goods storage area. From the three loading points, portable extendoveyors carry the bags to any position on the customer's truck.

Construction of this modern granular plant of fire-proof structural steel and American Steel Band "Steelbestos" was commenced by Fertilizer Construction Company, Inc., in March 1955, and the complete turnkey job, including washroom, garage, lunchroom, main building and equipment, power and gas lines, railroad siding and outside paving, was completed by the end of the year.★★

Construction view of the plant shows ammonia, phosphoric, and sulfuric acid tanks and steel framework.

Same view of completed plant shows railroad siding, washroom, and maintenance shop.



Credit, Making a Profit, Finance, —Highlight Discussion at NAC Convention in San Francisco.

"FOR several years the 'gossip mill' has been claiming that our portion (the agricultural chemicals industry) of the chemical industry has not been doing so good," said Fred Shanaman to the members of the National Agricultural Chemicals Association when they met at the Fairmont Hotel, San Francisco, March 6-8. "At least not as good as we have done, nor as good as most of us would like to," Mr. Shanaman continued.

This realistic view of the industry was made as Mr. Shanaman, president of Pennsylvania Salt Manufacturing Company of Washington, opened a cold analysis of the return on capital necessarily employed in the agricultural chemicals industry. He called forth the obvious rule that the object of any business . . . including the agricultural chemicals industry . . . is to make a profit,—and that the common denominator of all objectives in the internal affairs of a company is the factor of return. "Simply stated," said Mr. Shanaman, "percent return on capital employed is the percent of profit from sales multiplied by turnover . . . which is readily portrayed by the following formula in which certain rounded figures are used for purpose of illustration:

$$\frac{\text{Net Profit \$100,000 x 100}}{\text{Sales \$1,000,000}} \times \frac{\text{Sales \$1,000,000}}{\text{Capital \$500,000}} = \text{\% return on capital employed}$$

This formula, he said, can be a workable tool if we seek a quick and easy portrayal of what we are returning from our efforts and on our capital employed.

Mr. Shanaman observed that bigness in agricultural chemicals in one form or another, is sometimes desirable, but is not necessarily a panacea for what may be wrong . . . nor will it necessarily accomplish what may be desired He noted that the quantity and quality of research being conducted by the agricultural chemical industry makes the factor of obsolesence extremely important. As plants and products become obsolete, a company must execute an orderly retreat, preferably at a more rapid rate than the decline of the product in the market place. Not to do this is suicidal. As a product reaches the end of its life cycle, orders are scattered, irregular, and turn more and more toward unprofitability.

"When we are experiencing one of our economic down-swings," the speaker continued, "the climate is inclined to turn from cool to frigid with respect to new capital. In a diversified company, each dollar requested for agricultural chemicals is judged more critically than before as to its ability to earn in comparison with other company activities. Outside capital doesn't show any great enthusiasm or willingness to invest, and borrowed money is difficult to come by except under terms and interest rates which seem to reflect a knowledge of what happens to us during one of these bilious periods."

In attempting to draw some significant comparisons between the agricultural chemicals business and other industries as to rate of profit, amounts tied up in inventories and accounts receivable, turnover, etc., Mr. Shanaman commented on the almost complete lack of authentic statistical data in this industry. Estimates made on the basis of such data as could be obtained, he reported, suggest that better than 50% of formulators doing a national business "are earning less than 4% on sales before taxes. Out-of-pocket costs are probably

70-90 cents on every sales dollar, leaving little to cover fixed costs and provide a profit. Total capital required is high, amounting on the average to between 70 and 75 cents for each sales dollar. *The major investment is not in plant and equipment but in current assets namely inventories and accounts receivable.*

"In some cases, formulators consign their labeled products made from consigned raw materials or contentrates and the supplier of the raw material or concentrates thereby extends the consignment to the dealer or the grower level as the case may be. In certain instances inventory placed in resellers' warehouses is not only consigned, but the owner pays the reseller a storage fee. The evident effect of such practices is to increase the number of dollars tied up in inventories, increase the cost of goods to be sold, and considerably increase the paper work for the seller.

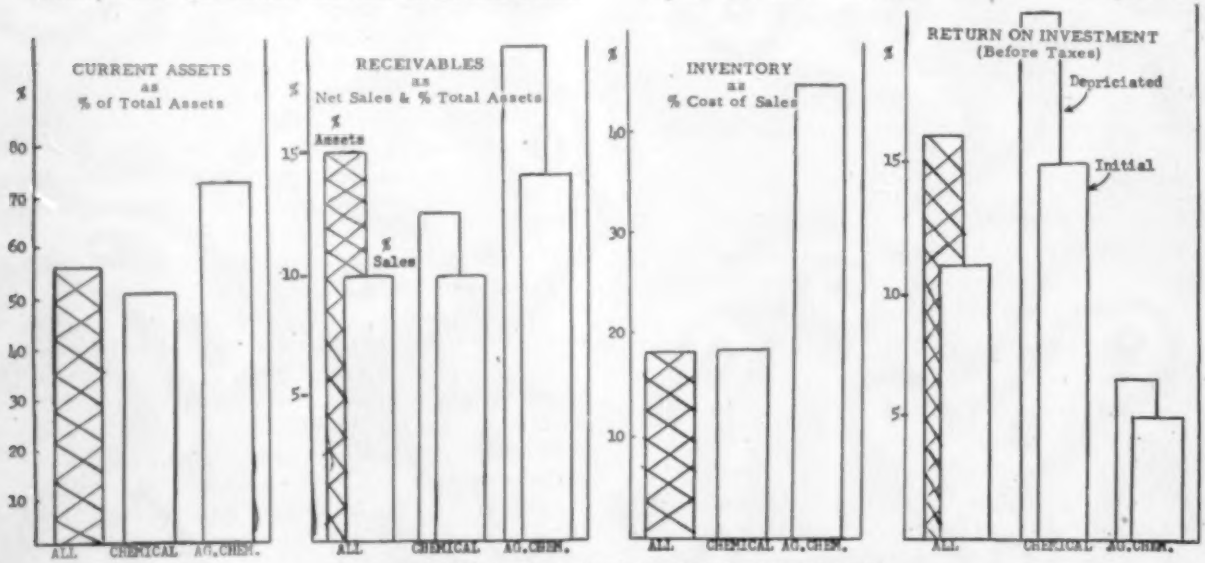
"In the case of accounts receivable, our record is abnormally high when compared to the average of all industries. Terms of 30 days net are the exception, rather than the rule. Invoices made at time of shipment carry 30 day terms but frequently, by agreement, payment is not required for 60-90-120 days, or longer. In other instances, invoicing is actually delayed for 60-90 days or 120 days beyond time of shipment, and after making use of such liberal credit, the buyer still has 30 days in which to pay. To make matters worse, the invoice price is the price at time of shipment, but protected against decline. We also have an industry practice of 'crop terms' which fortunately, in the past, has not been widespread but which seems to be growing. This practice usually calls for invoicing at time of shipment but payment is not required until the end of the season and after the customer has sold the products for which the sellers' goods have been required and used. In such cases also, prices are reported to be guaranteed against decline.

"An average manager in this industry is unquestionably faced with the fact that each of his sales dollars requires an investment of between 70 and 75 cents. Long term credit along with practices used for credit extension are hard to justify if we consider accepted good credit policy, today's costs of money and low profit margins estimated to be prevalent throughout the industry. Let us assume that there are some enjoying much higher profit margin than average. The picture for them doesn't look too good if we judge the effect upon their return on investment for a sale when soft credit terms are allowed. One analyst has stated that a product showing a 40% margin provides only 10% return on an investment after four months on the seller's books as a receivable. Whether we agree with his arithmetic or not, it is safe to say that uncollectible receivables even on high margin sales have tremendous effect on both investment and return on capital necessarily employed. *Many times it probably would be better business judgment to risk the loss of a sale rather than carry excessive inventory or grant such liberal terms that they would be difficult to duplicate with institutions set up for the purpose of lending money.*

To illustrate the position of the agricultural chemicals industry, in comparison with other industries, Mr. Shanaman presented a series of charts, which are summarized at right. The mythical "Random Agricultural Chemical Co." is formed using estimates obtained from a number of sources to construct results which, he said, typify experiences of recent years.

Chart A shows Random's return on investment, which experience is considered to be typical for the Agricultural Chemicals industry as it existed in 1956. Assuming a sales volume of $10 million with earnings as a percent of sales at 8%; capital investment of $12,600,000 with a turnover of .79; the resultant return on investment is 6.2%.

Chart B shows changes which could be made to bring Random Agricultural Chemical Company's earnings in line with the average for all industries with respect to return on investment. From the comparisons



Comparison of Agricultural Chemicals with Other Industries 1956

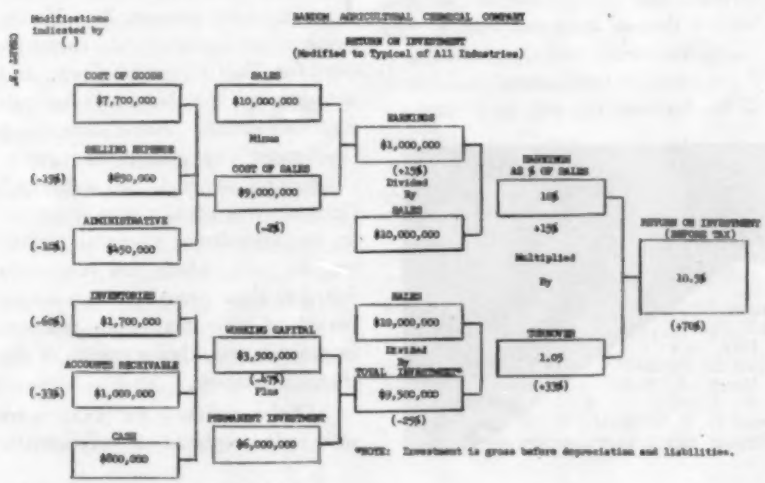
disclosed it is apparent that the return for industry at large is more than 50% higher than for the mythical, but typical Random Agricultural Chemical Company.

In considering the effect that an agricultural chemicals division may have in depressing the earnings of a diversified chemical company, Mr. Shanaman noted that, if such a company has the normal industry-wide return rate of approximately 15% on its sales outside the agricultural chemical field, and perhaps 25% of its total sales in pesticides, at an average profit rate for the pesticide field, the profit on sales for the entire company would drop appreciably (from 15% to 13.25%) and return on invested dollars would decline by 18%. Assuming that company capital could be used in other phases of the company's business at a rate of return comparable to its other non-agricultural lines, there would be strong resistance to putting company dollars into the pesticide division. The low turnover rate in the pesticide field of only .8%, added to the low profit margins, high inventories and long-term credit involved, the speaker indicated, make the pesticide field a less and less attractive business in which to invest corporate funds.

"In an industry with major segments paying as much as 7% of sales for research and development, including expenditures for tolerances under the Miller Bill, as compared to less than 2% for the chemical industry and allied products, it is important to know how such large expenditures affect return on capital. When such expense is added into administrative and sales costs, it has the effect of reducing return on investment by 10% to as much as 20%. Obviously, to know what is being earned by agricultural chemicals, such important items as research and legal expenses must be included.

"Referring again specifically to formulators, the average percent of profit is so low as to indicate a necessity to look for the opportunity to reduce manufacturing costs, raise prices, eliminate low margin items, alter formulations, and eliminate sales in unprofitable areas. For the industry, better management extended right down the line to the grass roots would be good medicine. This would include, but not necessarily be confined to better inventory controls, improved credit policies and rendering of sound and reasonable service to customers to the extent that it could be afforded in the face of then existing competitive conditions."

Concluding his observations, Mr. Shanaman said: "There is nothing new or startling in the idea of making profit, or of management's responsibility for a profit. The basic homespun business principles apply to operation of a peanut stand, as well as to a colossus like General Motors, with respect to earning a reasonable return on dollars. The same principles apply to a company engaged in the agricultural chemicals business."



Credit and Money

ALSO relative to a healthier, prosperous industry, discussions on credit and money by J. A. Walker, credit manager for the Standard Oil Co. of California, and Earl Coke, vice president of the Bank of America, continued the theme set by Mr. Shanaman.

"Credit skillfully administered for the convenience of customers is a rich source of goodwill, friendship and loyalty," noted Mr. Walker, who pointed out that any successful credit program is dependent on five essentials: "sound policy, sound administration, effective collection of receivables, healthy customer relations, and a good management climate." "A tough marketing situation," he continued, "can never be permanently overcome through longer terms, loose credit analysis, or lax collection effort. Such thinking can only lead,—as it has in so many instances—to

At podium: Fred Shanaman, Pennsylvania Salt Manufacturing Company of Washington. Seated (l. to r) J. V. Vernon, Niagara Chemical Division, and vice president, NAC; John T. Coyne, USDA, and R. L. Furniss, Pac. N.W. Forest Station.

Earl Coke, Bank of America; C. O. Barnard, Western Agricultural Chemicals Association; Fred Hatch, Shell Chemical Corp., and president of NAC; S. B. Freeborn, University of California; and A. F. Kirkpatrick, American Cyanamid Co.

credit abuses that threaten the soundness of a firm's financial program—abuses that can result in the break down of the credit structure in any industry.

When the credit structure breaks down," he observed, "no one gains, and everyone is faced with higher costs and reduced profits. Any marketing program that, instead of merchandising products and services, depends upon the selling of credit concessions — or the unsound mortgaging of the future for the temporary present—is on boggy ground." Factual credit analysis depends on two things, said Mr. Walker: access to reliable sources of information and skill in appraising the paying ability of customers.

Observing that there is no better use of operating capital than to carry sound receivables, Mr. Walker also noted that receivable turnover, like inventory turnover, is a significant indicator of how well dollars are being employed. As receivables age, their collectibility decreases, and manpower and collection costs, to say nothing of losses, increase. The cost of a credit organization is usually in direct proportion to the condition of receivables.

Citing Dun & Bradstreet figures, Mr. Walker noted that there are some 2,650,000 businesses in the United States. Half of these firms, he said, are worth less than $10,000, and only 5% are worth more than $125,000. There is of course a considerable turnover of such businesses. By the end of this year, for instance, about 20% of these smaller concerns will have discontinued operation . . . which should emphasize the necessity for constant and skilled analysis in the administration of credit.

Discussing the farm credit situation, Mr. Earl Coke quoted the recent study conducted by the Federal Reserve System showing that "Farm debt has been growing in the last several years while farm incomes were declining. In mid-1956, all farm debt (exclusive of Commodity Credit Corporation price advances) totaled $18.5 billion, about 6% higher than a year ago, and larger in dollar amount than at any other time."

Considering total farm debt as a per cent of total assets, said Mr. Coke, farmers are still in a strong financial position, although they have been losing ground a little in this respect the last five years. Currently farm debt outstanding is about 11% of the value of total farm assets, and about 95% of present liquid or financial assets. In 1940 comparable figures were 18.5% and 200%, while in 1950 they were 9% and 70% respectively.

Mr. Coke observed that while the demand for money today is in excess of supply, agriculture—even using its broadest definition — has been little inconvenienced or hampered by the present shortage. Money is available to farmers from many sources—both public and private institutions . . . and furthermore, banks generally make production loans based on carefully developed budgets in which are included all items for out-of-pocket costs.

NAC board: (l to r): Fred Shanaman, J. D. Hopkins, E. Phillips, G. L. Dily, Jack Vernon, Lea S. Hitchner, F. Hatch, A. Mohr, Loren P. Scoville, C. S. Sommer, Jr., C. M. Brown, G. C. Romig, and T. L. Wilkerson.

Our present economic position

IN some observations on our overall economic position, Fred Hatch, manager of agricultural chemicals sales for Shell Chemical Corp., and president of the National Agricultural Chemicals Association, said "the cost-selling price-profit squeeze is affecting all of U. S. industry." Certainly it is nothing new or unique in the agricultural chemicals industry, he said, which has been subjected to these pressures for a longer period of time than both industry in general, and other segments of the chemical business.

"Sales volumes for 1956 were universally reported as substantially

higher than those of the previous year; while profits were reported to be lower and in some cases, non-existent." Increased costs of labor, materials, freight, and containers, as well as higher sales costs were reported as not being reflected in consumer product prices.

Mr. Hatch observed that there are inherent difficulties in scheduling production and planning distribution of products for a seasonal market, which can easily fluctuate in size by several hundred per cent, depending upon such unpredictable factors as weather, degree of insect infestation and incidence of disease. He reported too that the agricultural chemicals industry has for several years had a plant capacity both for the manufacture of basic compounds and formulation of finished products far in excess of current needs. Disposal of surplus output, he observed, has naturally led to demoralized markets. "For this reason, it can be anticipated that primary attention must be directed to the sales effort for the next several years."

Discussing the sales job, Mr. Hatch defined the agricultural chemicals business to contain 60% of its sales in the domestic agricultural market, 20% from sales of products for non-agricultural uses in the domestic market, and the remaining 20% in export sales. He suggested that NAC might profitably give serious consideration to the benefits derived from adding an agricultural economist to its staff, who could correlate available statistical data on undeveloped market potentials, and thus stimulate development of more comprehensive studies by state and federal agencies on the cost of crop losses incurred by insect and disease damage.

Further discussing promising areas for expansion of pest control, Mr. Hatch said that forest pest control should be placed high on the list,—that turf has become big business, as has the home garden market. Other promising markets include weed and brush control and the control of termites and other household pests.

(*Continued on page* 123)

RESISTANCE TO INSECTICIDES

By R. C. Gaines
Entomology Research Branch,
Agr. Res. Serv., U.S.D.A.

THE possibility of resistance in the cotton leafworm to toxaphene was first suspected in Venezuela in 1951 by W. H. Whitcomb. He reported his observations at the 1952 Conference on Cotton Insect Research and Control. During 1953 and 1954 there were indications that higher dosages of toxaphene might be required to kill cotton leafworms in certain areas of Texas. Laboratory tests confirmed the field observations.

In Louisiana during the extremely hot and dry summer of 1954 reports from several areas indicated that the chlorinated hydrocarbon insecticides were not giving satisfactory control of the boll weevil. The weather was generally accepted as a possible explanation. However, again in 1955 under entirely different weather conditions, many cotton growers reported unsatisfactory control. This situation prevailed in the Mississippi River Delta of northern Louisiana, the Ouachita River Valley south of Monroe, the Red River Valley in northwestern Louisiana, a small area in southeastern Arkansas, and a large area in the south delta of Mississippi.

In small-plot experiments at Tallulah, Louisiana, the control of boll weevils with six chlorinated hydrocarbons was satisfactory from 1950 through 1952. There was somewhat less control in 1953, still less in 1954, and very little in 1955. In addition to the records obtained at Tallulah by the Entomology Research Branch, entomologists of the Louisiana Agricultural Experiment Station made observations and counts in many fields throughout the state and in field-plot experiments at St. Joseph, Natchitoches, and Church Point. These together with results obtained in cage and laboratory tests have been reported by John S. Roussel and Dan Clower (La. Agr. Expt. Sta. Cir. 41). By the end of 1955, it was clear that the chlorinated hydrocarbon insecticides were no longer giving control of the boll weevil in some areas of that state.

In November 1956 L. D. Newsom of the Louisiana Agricultural Experiment Station mailed a questionnaire to entomologists in the cotton-producing states to determine the status of resistance to insecticides in cotton pests. A summary of the re-

plies was published in the *Cotton Trade Journal* on December 14, 1956, and will be included in the 1956 Conference Report on Cotton Insect Research and Control. Briefly, entomologists reported that the boll weevil is resistant to chlorinated hydrocarbon insecticides in parts of Arkansas, Louisiana, Mississippi, South Carolina, Texas, and suspected in areas of Alabama. The largest areas involved in this resistance occur in Louisiana, principally in the alluvial areas where about 75 per cent of the state's cotton crop is produced. On a percentage basis, the areas involved in other states are much smaller. Resistance to one or more of the recommended chlorinated hydrocarbon insecticides has appeared also in the salt-marsh caterpillar in Arizona and southern California, in the cabbage looper in California and Louisiana, in the onion thrips in a small area in southern Texas, and resistance to phosphorus insecticides in some species of spider mites in California. In addition, resistance to chlorinated hydrocarbons is suspected in the cotton aphid in Alabama, Arkansas, Louisiana, and Mississippi, in the beet armyworm and southern garden leafhopper in California, in the cotton leaf perforator in restricted areas of the Imperial Valley of California, in lygus bugs in Arizona and California, in thrips in Mississippi, and resistance to sulfur and phosphorus insecticides in spider mites in Mississippi and South Carolina.

In areas where boll weevil resistance to the chlorinated hydrocarbons has been proved, insecticides having a different mode of action should be used. The organic-phosphorus insecticides and calcium arsenate are the only effective chemicals available at this time. The hazards involved in their use are well known. Entomologists have little basis for believing that the current substitutes will be the permanent answer to the boll weevil resistance problem. Flies resistant to phosphorus are reported in Denmark, mosquitoes resistant to phosphorus in California, and it is well known that spider mites readily develop resistance to phosphorus compounds. The codling moth in Colorado and the blue tick in South Africa developed resistance to arsenicals.

For the past decade need for applied research has allowed little time for basic investigations. Insecticides have provided the only generally reliable control for most cotton pests and more efficient methods of using them have been developed. It was therefore not a mistake to put so much effort on the continued search for and the testing of new and better insecticides. If cotton-insect resistance to the chlorinated hydrocarbon insecticides becomes general and widespread, substitutes would have been very limited without the organic-phosphorus insecticides.

Not any of the biochemical and few of the physiological and other questions about resistance in cotton pests have been answered. Cooperative basic research on this subject, with special emphasis on the boll weevil, was started at Baton Rouge, Louisiana, in July 1956, by the Louisiana Agricultural Experiment Station and the USDA Entomology Research Branch. Studies are being made to determine (1) through biochemical and physiological research, the mode of action of different insecticides; (2) the mechanism or manner in which boll weevils detoxify or otherwise render an insecticide harmless to themselves; (3) how many generations are required for the weevil to lose resistance to a chlorinated hydrocarbon after it has been acquired; (4) how many generations are required to develop resistance to a chlorinated hydrocarbon; (5) whether resistance will develop as rapidly, if at all, when weevils are exposed simultaneously to two types of insecticides such as a chlorinated hydrocarbon and a phosphorus compound; (6) whether weevils already resistant to chlorinated hydrocarbons will become resistant to a phosphorus compound, and if so, how many generations will be required; (7) whether weevils not resistant to chlorinated hydrocarbons will become resistant to a phosphorus compound, and if so, how many generations will be required; (8) the degree to which the weevils have already developed resistance to a chlorinated hydrocarbon and whether resistance increases in subsequent generations.

Fortunately, resistance of cotton pests to recommended insecticides is still restricted to a very small portion of the Cotton Belt. However, this serious problem emphasizes the importance of utilizing to the fullest extent possible cultural practices and other methods of natural control known to be effective in reducing the population of injurious insects.

A well balanced farming program encompasses the full use of approved cultural practices which tend to reduce damage caused by insects. Insecticidal control should always be supplemental to these practices which include (1) destruction or killing of cotton plants as early as possible before the first killing frost, (2) early planting in a given area, (3) planting of a recommended variety, (4) soil improvement and fertilization, (5) location of cotton fields as far as practicable from other hosts of cotton pests, (6) cleanup of hibernation shelters, (7) use of soil-building and soil-conserving leguminous crops, and (8) chemical defoliation and desiccation. If the boll weevil could be controlled largely with cultural practices, parasites and predators might have a better chance of keeping certain other cotton pests under control.★★

Insecticides have provided the only generally reliable control for most cotton pests.. The continued effort in search of new and better insecticides is well spent.

There's a Fungus Among Us

CONTAMINATED COTTON

Verdict:

Joe Grower found GUILTY as charged . . . guilty of allowing his cotton to become infected with damping-off because he neglected to treat his soil with TERRACLOR. This new Olin Mathieson fungicide for certain soil-borne diseases is available as 10%, 20%, and 40% dust . . . 75% wettable powder . . . 2 lb. emulsifiable. Joe Grower's neglect is inexcusable since often one application of TERRACLOR is effective from planting time to crop maturity.

Sentence:

Joe Grower will pay the penalty—poor yields and low revenue. The Court warns Joe Grower that he can receive the same penalty when growing other crops. Therefore, he is warned to use TERRACLOR for controlling other soil-borne diseases such as club root, black root, crown rot, root and stem rot, leaf drop, bottom rot, scab, white rot, and common smut when growing alfalfa, clover, green beans, lettuce, garlic, wheat, potatoes, crucifers, and certain ornamentals.

Terraclor
OLIN MATHIESON CHEMICAL CORPORATION
INSECTICIDE DIVISION • BALTIMORE—LITTLE ROCK

TERRACLOR® is a trademark

4514

MATHIESON

Aldrin • BHC • Chlordane • DDT • Dieldrin • Endrin • Ferbam • Grain fumigants • Heptachlor • Lindane • Malathion
Omazene • Parathion • PCP • Phosdrin • Phytomycin® • Rotenone • Seed protectants • TEPP • Weed and Brush Killers

Presiding officers at the Alabama Pest Control Conference were; (left to right) L. M. Ware; F. S. Arant; Coya Wilson; John R. Cook, president; and Wade Allen.

A BETTER JOB of PEST CONTROL

—theme of Pest Control Conference at Alabama Polytechnic Institute

"HOW to do a better job of pest control"—was the theme of the tenth Alabama Pest Control Conference held February 19 and 20 on the campus of Alabama Polytechnic Institute, Auburn, Alabama.

Some 200 representatives of nine states were on hand for the programs to discuss insect control, weed problems, rodents, diseases, and nematodes, compatibility of liquid fertilizers, reducing hazards of phosphate applications, and many others. Representatives from 65 commercial pesticide firms attended, as well as research, extension, newspaper, and magazine personnel.

Joseph E. Burger, vice-president and sales manager of Corneli Seed Co., St. Louis, keynoted the two-day conference with a talk on "How to Get Better." Stressing the importance of salesmanship, Mr. Burger said, "No matter how good we think we are in our profession or business, the day we stop getting better, that day we stop being good."

For success in business, he emphasized the importance of a good product and a good job of selling. Character, hard work, ability, courage, and personality, in that order, are the five qualifications for successful salesmen. "But without character, first and always, the salesman will not succeed, even though he may possess all of the other four qualities."

The proper use of "your eyes, your ears, and your big mouth" was stressed by Mr. Burger in his description of good salesmen. "Learn to listen with your eyes as well as your ears and learn to keep your big mouth shut. More sales are lost by talking too much than from most other causes," the executive declared. Burger's parting advice to the group on good salesmanship was "learn to smile."

Meeting in conjunction with the Pest Control Conference was the Alabama Association for the Control of Economic Pests, a group that organized at the 1956 conference. Re-elected to second terms to head the Association were: George Williamson, Agricultural Chemical Service Co., Montgomery, president; Urban L. Diener, assistant plant pathologist of the API Agricultural Experiment Station, vice-president; and W. G. Eden, Experiment Station entomologist, secretary-treasurer. George P. Wilson, aerial applicator, Summerdale and O. H. Bowden, Farmers Marketing Exchange, Montgomery, were elected as directors, succeeding Oscar Frazier, Selma, and H. C. Young, Florala. Other directors are T. J. Cavanagh, Mobile; N. R. Downey, Birmingham; D. P. Livingston, Montgomery; and J. E. Zeigler, Millbrook.

T. W. Reed Discusses Liquid Fertilizers and Pesticides

SPEAKING on compatibility of liquid fertilizers with pesticides, T. W. Reed, California Spray Chemical Corp., said liquid fertilizers are increasing in many areas because of several advantages. Among the advantages, he noted that pesticides can be added easily to liquid fertilizers for a combination soil treatment.

Mr. Reed listed the following classes of pesticides as such that can be added to liquid fertilizers: (1) Insecticides or weed killers added to foliage sprays. These may be either emulsifiable concentrates, solutions, or wettable powders. (2) Insecticides added directly to the transplanting solution, either emulsifiable concentrates or wettable powder suspensions. (3) Insecticides added to broadcast fertilizer applications or side dressings. These are added in the form of emulsifiable liquid concentrates or wettable powder suspensions. The problem of compatibility is somewhat different for the various types of applications.

"Foliage applications of fertilizers are applied in dilute water solutions. Because the solutions are dilute, the physical compatibility problems are generally not as serious as for some of the other applications. Physical compatibility is the least important when mixing wettable powders with foliage fertilizer sprays, since most all wettable powder products are not seriously affected by the fertilizer elements in solution. However, the chemical compatibility must be considered.

"The chlorinated hydrocarbon insecticides, as a class, are generally compatible with foliage sprays of liquid fertilizers. Compatibility of phosphate insecticides is questionable, since many of these have their efficiency reduced by alkaline solutions and some are adversely affected by acid solutions, both of which may occur with various formulas of liquid fertilizers used as foliage sprays. The arsenicals, such as calcium or lead arsenate, are generally considered unsafe in these combinations, even though there are specific instances, such as combinations of urea with lead arsenate, which are quite satisfactory." Mr. Reed stressed the point that the user have specific knowledge of the exact mixture of pesticide and foliage fertilizer he intends to use to determine compatibility.

Using insecticides in transplanting solutions presents much simpler problems, Mr. Reed continued. This is true because types of fertilizer used in transplanting solutions and types of insecticides added are fewer and more standardized than for other types of applications. "Normally, a transplanting solution is a mixture of nitrogen, phosphorus and potassium in a non-injurious form that is quickly absorbed and utilized by the plant. These mixtures are used at a rather dilute concentration to avoid plant injury. Consequently, compatibility problems with pesticides are reduced to a minimum. It is quite common for a liquid insecticide to be added directly to the transplanting solution. Wettable powders frequently are recommended for transplanter solution usage and are in general quite satisfactory. The pesticide-liquid fertilizer combinations used in the largest volume are for broadcast application to soil and sidedressing of growing crops, Mr. Reed reported. Since these fertilizers are generally concentrated to save handling costs, freight, container costs, and ease of application, compatibility problems are increased.

Because pesticides that can be put into solution and dissolved in liquid fertilizer are quite active chemically, they cannot be mixed and stored with the fertilizer without losing their activity, he stressed. This makes it necessary that the pesticides be added to the fertilizer at time of application.

"The pesticides used most commonly in combination with fertilizers are the chlorinated hydrocarbon soil insecticides, such as the emulsifiable concentrates of aldrin, chlordane, endrin, heptachlor, and lindane. These are added to the desired amount of liquid fertilizer, so that normally ½ to 5 pounds per acre of the active ingredient are applied.

"Some of these insecticides are available as wettable powders and may be added directly to the liquid fertilizer. In this case, agitation in the tank must be provided to prevent separation and to maintain a uniform mixing of the insecticide and fertilizer."

Another use of the combination reported by Mr. Reed is the use of liquid fertilizer and insecticides in irrigation water. This permits fertilizing, irrigating, and treating for turf and soil-inhabiting insects in one operation. No special problems are associated with this type of application, since the fertilizer and insecticide are in very dilute forms at mixing time, he concluded.

Height of the banquet held by the Alabama Association for the Control of Economic Pests was the honoring of Jerry Ruffin, API Extension entomologist. The Association presented a plaque to Mr. Ruffin to recognize him for his outstanding contribution to the pest control field in Alabama.

THE problem of toxicity of the organic phosphate insecticides was discussed by E. P. Broadus, president, Mississippi Entomological Association. He said the use of phosphate chemicals is definitely increasing, and will continue to increase, depending on the extent to which boll weevils develop resistance to the chlorinated hydrocarbons. Unless applicators and farmers are educated to the danger of these compounds and care is taken in their use, deaths could result, he declared.

(*Continued on Page* 111)

left—Reelected to head the association for 1957 were (left to right); W. G. Eden, secretary; George Williamson, president; and U. L. Diener, vice president.

center—Jerry Ruffin (right) receives plaque for outstanding service from J. L. Lawson.

right—Frank McQueen and T. W. Reed talk over the meeting with U. L. Diner, program committee chairman.

available in limited quantity!

BRELLIN*

Water-Soluble Powder
CONTAINING
GIBBERELLIC ACID

Penick now offers this promising new plant-growth stimulant in a convenient special formula that simplifies application in the small amounts required.

One level teaspoonful (2.5 grams) in one pint of water makes a solution containing 10 p.p.m. of gibberellic acid, the concentration that has generally produced the best response. Of course, other concentrations can be made by varying the amount used.

Since supplies of BRELLIN are limited, all orders are subject to availability and confirmation.

*Trademark

"The World's Most-Wanted Killers"
Di-Sodium Methyl Arsenate • Dethmor® Warfarin • Pro-Noxfish® • Sulfoxide®

Agricultural Chemical and Insecticide Division
S. B. PENICK & COMPANY 50 CHURCH ST., NEW YORK 8

PENICK
735 W. DIVISION ST., CHICAGO 10

Top: T. Katsuda observing use of Vapam in greenhouse for sterilizing hothouse soils.

Bottom: Bed sharper on rear of tractor helps shade beds, break clods and seal gases into treated area.

Right: Treated strawberries produce vigorous plants and early bloom.

Soil fumigation with Vapam

DURING the past season, Vapam, the soil fumigant developed and manufactured by Stauffer Chemical Company, has been widely utilized for a number of agricultural purposes. It has, through the cooperation of many federal and state agencies, agricultural scientists associated with universities, and private growers, been evaluated both on a broad variety of different crops and under varying climatic conditions.

At present, applications to ornamental, vegetable seed bed, turf and forest nursery tracts are high on the roster of commercial uses. Too, Vapam has been used extensively for the preparation of tobacco seed beds.

In both Florida and California, many growers of Gladioli have proved Vapam to be efficacious in controlling soil fungi and nematodes. Other ornamental applications include: Chrysanthemums, Carnations, Roses, Azaleas, Camellias, Pansies, Asters and such foliage plants as Philodendrons, Chinese Evergreen, Pothos, Sansevieria and Diffenbachia.

The new soil fumigant has also been used commercially on turf — either to renovate old sod or to start new plantings by sprigging or seeding. The main areas of interest are, of course, football fields, golf courses, race track infields, and civic parks.

Farmers who grow turf as a crop have made use of Vapam as a temporary soil sterilant prior to setting out new plantings. This has come to be a popular and profitable practice in both the midwest and south. It can be readily applied through irrigation systems and reports are that virtually complete control of weeds, Bermuda grass, and nut grass, can be effected through a 100 gallon per acre treatment.

Because of the susceptibility of seedling vegetables to damp-off organism — and the reduced crop yields caused by competing weeds and root-crippling nematodes — Vapam has won wide acceptance for treating vegetable seed beds in Florida, New Jersey, Georgia and California. Ex-

(*Continued on Page* 119)

Analysis of Triple Superphosphate

IN past years, laboratories have had difficulties in securing comparable values for phosphorus, particularly in high phosphate materials. This discrepancy was brought to the attention of the Chemical Control Committee of the National Plant Food Institute with the request that they ascertain the cause of variance when it was assumed all laboratories were using the Official Method of the A.O.A.C. for analyzing the material.

The first step was to make a survey by questionnaire of many industry laboratories to find out the minute details of the methods each used to analyze superphosphates and mixed fertilizers in their respective laboratories. Eighteen replied: each followed the Official Method in a general way: However, variance occurred in: sample preparation, digestion (acid ratio and time), filtration (paper grade and type of filter), precipitation and precipitate washing; titration of the phosphomolybdate was fairly uniform.

From the questionnaire data and personal conferences with those who have worked in developing analytical methods, information was developed by which a collaborative program was prepared. The first phase of the study was designed to ascertain the most effective moisture procedure, the effect of three variations of acid digestion, and the appropriate size of sample to use for molybdate precipitation. A uniform prepared sample of triple superphosphate was obtained and forwarded to twenty two collaborators along with minutely detailed instructions.

The return from the collaborative work showed:

1. Moisture via vacuum was 2 percent or more, less than 100°C.
2. Fair uniformity of moisture at 100°C was attained.
3. No significant variances were developed by varying the ratio of HCl to HNO_3 for perchloric acid—HNO_3.
4. Collaborators had less individual deviation using a 0.10 gm. sample.
5. Collaborators showed significant individual deviations using a 0.05 gm. sample.
6. Results using 0.05 gms. sample uniformly were 0.20 percent higher.
7. Variations between collaborators were as much as 1.5 percent, although the majority were within 0.40 percent.

The results of the preceding study indicated that the deviations might lie in the technique of precipitation. To test this theory, a pure, completely soluble salt (monopotassium phosphate) was used. Identical samples and detailed instructions for precipitation and titration were sent to the previous collaborators.

Results: the salt contained more P_2O_5 than theoretical owing to unexpected impurities. Subsequent analysis proved this true.

The returns from the collaborative work on the monopotassium phosphate showed:

1. Significant deviations, between replicates by the same operator on different days.
2. Deviations between collaborators greater than in the preceding study. Spread between high and low was larger, although the majority when averaged were in the same range.
3. The use of 0.05 gm. sample probably accounts for the deviation, and indications are that more experience on the part of the laboratory workers with this size of sample may reduce the deviation.
4. The question of precipitation and titration was not wholly resolved.

A capitulation of the results and experiences gained from the several series of this collaborative study clearly set forth the approximate mechanics required to approach uniformity of analytical values from different laboratories.

Accordingly, there was designed and initiated a collaborative study on the complete analysis of triple superphosphate.

Complete Anaylsis of Triple Superphosphate

Experimental:

The list of collaborators was expanded to include many more laboratories. Ten laboratories that had participated in the previous work were requested to do supplemental work to determine the effect of variations in technic in moisture and water soluble determinations. To evaluate the precision of each laboratory with respect to time, each collaborator was requested to run duplicates at the same interval.

Sample Source and Preparation:

1. Triple Superphosphate ground to—35 mesh and bottled at the Davison Chemical Company plant, Barton, Florida.

Instructions to Collaborators:

A. General
1. Run analyses in duplicate.
2. Report each duplicate value regardless of variance: it may help in the evaluation of the overall data and be of significance to you. In case of mechanical errors, repeat immediately.
3. Make 2 series of analysis. Report all values just as you obtain them. Each series to be *exactly 7 days apart.*

Volumetric Analysis of Triple Superphosphate

A REPORT OF COLLABORATIVE STUDIES

By H. L. Marshall and M. N. Replogle***

4. To help evaluate the data, include in your report under comments, the weather conditions at time of making each analysis; i.e. outside temperature, laboratory temperature, and humidity conditions.

B. Detailed—Primary Results

a. Moisture

Sample Weight
2 gms. if 5 cm. dia. dish used
5 gms. if 10 cm. dia. dish used

Electric Oven
100°C; 5 hours

Vacuum dessicator
Room temperature
20 in. of vacuum
18 hours

Note: If electric oven is used, place dish as close to thermometer or regulator as possible. Oven or dessicator load should not be such as to saturate air or dessicant. Under "Comments" in your report please give type of oven and whether air is circulated through the oven or not.

b. Total P_2O_5

1. Sample weight: 1.0 gram.
(Duplicates if desired. Report all values.)
2. Put sample in 400 ml. beaker or 500 ml. volumetric flask.
3. Digestion
10 ml. HCl—30 ml. HNO_3.
Digest 15 minutes after the acid mixture starts to boil. Cool by adding 150-200 ml. cold distilled water.
4. Making to volume
500 ml. volumetric flask.
If digestion is made in beaker, transfer to volumetric flask by water washes of 50 ml. each.
5. Filter solution into Florence Flask (500 ml.) through a Whatman #2 or #12 filter paper.
6. Aliquot
A. 250 ml. wide-mouth Erlenmeyer or 400 ml. beaker or glass.
B. From filtered volumetric solution take a 25 ml. aliquot.

(1) A special study sponsored by the Chemical Control Committee National Plant Food Institute

* Chemical Control Committee, NPFI.
** Davison Chemical Company, now with Olin Mathieson Chemical Co., Baltimore, Maryland

7. Proceed with precipitation and titration as under Section E.

c. Water Soluble P_2O_5
1. Sample weight—1.0 gm.
2. Transfer sample to preformed 9 cm. #2 Whatman filter paper in a funnel.
3. Wash with successive washings via gravity until total wash volume is 225 ml. (Be sure each wash is through the filter before the next wash).

Summary

The Chemical Control Committee of the National Plant Food Institute in early 1955, noting that differences existed throughout the country in the analysis of high P_2O_5 goods, such as triple superphosphate, decided to do something about this.

The differences were felt to be due to variations in the interpretation of the official A.O.A.C. analytical methods. The Committee set out to study through collaborative work the effect of such differences in the mechan.cs of the methods.

The results of the three studies conducted from May 1955 through August 1956 show that:

1. **Chemists' interpretations of the official procedures differ widely.**
2. **Collaborators differed in results, even when using specific mechanics.**
3. **A criterion for accuracy in the analysis of triple superphosphate does not exist at present.**
4. **Precision of test varied from collaborator to collaborator.**
5. **Various modifications of the specific mechanics of the official methods may be feasible to reduce the degree of variability among chemists and to improve precision in results.**
6. **Statistical methods in the analysis of collaborative studies are useful to describe more clearly the progress of such work. The diagrams and charts used by the quality control engineer can be utilized to show the results of such studies.**

Collect washings in a 500 ml. volumetric flask to which 5 ml. HNO_3 has been added.

4. After washing, make to volume and mix well.
5. Aliquot
   A. 250 ml. wide-mouth Erlenmeyer or 400 ml. beaker or glass.
   B. From volumetric solution take a 25 ml. aliquot.
6. Proceed with precipitation and titration as under Section E.

Note: Please report time required to wash sample with water.

d. Citrate Insoluble P_2O_5
1. Residue from water washes introduce into 250 ml. Erlenmeyer containing 100 ml. of neutral ammonium citrate solution at 65°C.
2. Place in water bath maintained at 65°C.
3. Agitate continuously or intermittently for 1 hour.
4. Filter solution after digestion using suction or fast gravity filter. Use Whatman #2 or equivalent.
5. Wash citrate residue with successive washing of 65°C. distilled water until total filtrate volume approximates 350 ml.
6. Return residue and filter paper or pad to digestion flask.
7. Add 10 ml. HCl—30 ml. HNO_3 to residue in flask.
8. Digest by boiling 15 minutes.
9. Cool by flooding with distilled water to 150 ml. volume.
10. Transfer residue solution to 250 ml. volumetric flask by washing.
11. Make to 250 ml. volume and *mix well.*
12. Filter through dry Whatman #2 or #12 filter paper with Florence Flask.
13. From filtered volumetric solution take a 50 ml. aliquot.
14. Proceed with precipitation and titration as under Section E.

e. Precipitation and titration of P_2O_5
1. Preparation of aliquot for precipitation
   a. Add 15 ml. 30% HN_4NO_3.
   b. Add 2 ml. of HNO_3.
   c. Adjust volume to 75 ml. with water.
2. Precipitation (Use ammonium molybdate adjusted with HNO_3)

(a) To adjusted aliquot add:
1. Total and water soluble, 40 ml. molybdate soln.
2. Citrate insoluble, 20 ml. molybdate solution.

3. Digestion
   Stirring (a) continuously, room temp. 30 minutes.
   (b) intermittently or 40°C., 30 minutes.

Note: Report stirring method under "Comments."

4. Filtration
   Suction:
   Moore-Shimmer or Hirsch Funnel — Paper pulp; Whatman #2, or equivalent layer of paper pulp or asbestos.
5. Precipitate washings
   10 washings of 15 ml. distilled water each washing, using washings to complete transfer from precipitation container.
6. Transfer washed precipitate to original precipitation container, using distilled water to assist transfer of any precipitate clinging to filtration funnel.
7. Adjust final volume in original aliquot container to 100 ml. minimum with distilled water.
8. Titration
   a. Dissolve preciptate with standard caustic solution, using 2 ml. excess.
   b. Let stand 10 minutes—closed, if practical.
   c. Add 0.5 mi. of 1% phenolphthalein indicator.
   d. Back titrate with standard acid to colorless, white or ph 8.0.

Calculate P_2O_5 from amount of standard caustic used.

Note: Restandardize caustic solution with potassium acid phthalate during analytical test. Report normality.

f. Special—Supplemental Results

In addition to the above primary outlined tests you are requested to run the following analyses. These data will assist in pointing up moisture mechanics and evaluating the effect of varying the technic on the water soluble and citrate insoluble values.

1. Moisture
   Sample—same as General Instructions
   Electric Oven
   100°C.
   5 hours
   Circulated Gas
   2 liters per minute

Note: The oven should be provided with an opening in the top for ventilation. Insert a ⅛" copper tube in the top and extend to the bottom of the oven. Connect the copper tubing to an inert gas supply, (Nitrogen or carbon dioxide.)

During the test allow inert gas to be discharged into the bottom of the oven at the rate of two liters per minute. The circulation of gas will sweep out the moisture vapors released from the sample and also aid in maintaining a more uniform temperature throughout the oven.

Report results as *supplemental* under the primary results.

2. Water Soluble P_2O_5.
   a. Sample weight: 1.0 gm.
   b. Transfer to 150 ml. beaker.
   c. Add 100 ml. water.
   d. Let stand 0.5 hour.
   e. Stir every 10 minutes while standing.
   f. Transfer to 9 cm. Whatman #2 filter paper. (Gravity filter).
   g. Wash beaker and filter with successive washings to total volume of 225 ml. in a 500 ml. volu-

metric flask to which 5 ml. HNO_3 have been added.

h. Follow General Instructions from this point on. Report values as *supplemental* underneath primary results.

3. Citrate Insoluble

a. Proceed as under General Instruction Section D above.

Note: Please report C. I. values on Report Sheet as supplemental underneath primary results.

Results:

The returns from the collaborators were tabulated and subjected to statistical analysis. Response was complete from all laboratories. Tables (1 and 2) and control charts* (1 to 20) were prepared from the data.

Statistical Methods Used:

1. Analysis of variance
2. Quality control technic using range statistics to estimate collaborator precision.
3. Multivariable charts.
4. Control charts.

Item 1.—The statistical method used for data analysis is known as the Complete Factorial Model. The detailed explanation of the mechanics of the analysis of variance for factorial experiments is covered in the referenced texts 1, 2, 3, and 4 and is not detailed in the scope of this paper.

Item 2.—The quality control technic used are the familiar type used by the quality control engineer in the analysis of process control data. The methods for such analysis are more fully covered in references 4, 5, and 6.

A brief explanation of the technic used in the studies in this paper is in order. This may best be illustrated through an example from Study No. 1.

Calculation of test precision using range. Results from Collaborator No. 1.

1. Using Aqua Regia
2. .10 gm. aliquot
3. Analysis in triplicate in one day.

Results — Total P_2O_5

Test 1 — 48.09%
Test 2 — 48.04%
Test 3 — 48.10%
Average— 48.08%
Range — 0.06%

Calculation of standard deviation σ of individual tests:

1. Equation

$$\sigma = \frac{R}{d_3^*}$$ where σ = standard deviation, R = range or difference in 3 tests, $^*d_3$ = factor equal to 1.693 for three results

* From A.S.T.M. Manual, p. 63. (reference 3)

2. Calculation

$$\sigma = \frac{.06\%}{1.693} = .035\%$$

3. Precision is expressed as three standard deviations or 3 x .035% = 0.105%
4. Precision of all collaborators is pooled over all estimates of precision weighted by number of results where necessary.

Control charts designed to show the state of control between collaborators as well as their internal precision.

1. Average of the three results are plotted consecutively starting with Collaborator No. 1 and continuing over all collaborators.
2. Range is plotted for individual collaborators using the difference obtained from the highest to lowest value.

Construction of multivariate charts designed to illustrate conclusions from analysis of variance in graphic form.

1. Chart is constructed by plotting the highest and lowest value obtained by each collaborator in the form of a large X. This form is the choice of the writer; other forms may be used.

General:

1. A significant difference between collaborators is found in this study for all items analyzed.
2. The difference exists in primary as well as supplemental results.

(*Continued on page 120*)

* The charts are not reproduced in publication of this article, but interested readers may check directly with authors for further details.

NPFI Study No. 3
Triple Superphosphate

Table I — Summary of Collaborators' Data - Avg'd. Over 2 Days

Collab. No.	Moisture Avg.	Moisture Precision $3\sigma_a$	Total P_2O_5 Avg.	Total P_2O_5 Precision $3\sigma_a$	Insoluble Avg.	Insoluble Precision $3\sigma_a$	Available (1) Avg.	Available (1) Precision $3\sigma_a$	Water Soluble Avg.	Water Soluble Precision $3\sigma_a$	Free Acid Avg.	Free Acid Precision $3\sigma_a$
1	3.81	.189	49.06	2.769	2.14	1.53	46.92	4.29	40.10	8.769	1.96	1.923
2	5.65	.438	47.56	.291	2.58	.102	44.98	.387	32.28	13.785	2.02	.349
3	3.98	.105	48.15	.438	2.28	.072	45.87	.219	41.73	.146	2.31	.175
4	4.16	.351	48.21	.219	2.38	.219	45.84	.438	42.01	1.748	1.85	.219
5	3.48	.729	48.35	.438	1.73	.219	46.63	.363	43.08	.874	2.38	0
6	5.56	.510	47.72	.699	2.21	2.04	45.51	.495	42.08	.233	2.66	.102
7	3.82	.321	47.63	.174	1.18	2.214	46.45	2.247	39.57	6.382	2.41	.044
8	3.27	1.923	47.51	.684	1.96	.117	45.55	.756	41.46	.423	3.05	.801
9	4.59	.321	48.02	.510	2.03	.540	45.99	.918	40.61	2.550	7.28	3.21
10	3.88	.801	47.69	.306	2.26	.363	45.43	.669	41.70	2.113	1.50	.160
11	3.85	.438	47.56	.219	2.84	.147	44.73	.189	42.40	.437	4.96	.393
12	3.80	.261	48.15	.438	2.69	.087	45.46	.495	42.45	.219	2.50	.146
13	2.51	.294	48.60	1.065	.59	0	48.01	1.065	40.75	.798	.028	0
14	4.21	.378	48.13	.537	1.73	.816	46.40	1.239	42.20	2.291	2.82	.423
15	4.17	.027	48.05	.267	2.18	0	45.87	.267	41.40	.532	—	—
16	4.54	.132	48.23	.234	2.07	.102	46.16	.174	43.05	.612	2.33	.102
20	4.66	1.296	47.80	.495	1.96	.159	45.84	.627	41.73	.685	2.55	1.064
21	3.37	.336	48.35	.438	1.96	.291	46.39	.438	42.33	.291	2.87	.175
22	4.11	.351	47.75	1.167	2.20	.351	45.55	.933	42.70	1.457	2.54	.466
23	4.48	.204	48.09	.276	1.63	.159	46.46	.261	42.21	.583	2.28	.146
24	4.78	.030	48.14	.291	1.78	.102	46.36	.276	40.96	.583	2.41	.073
25	4.44	1.092	48.10	.363	2.23	.159	45.87	.378	42.68	1.238	2.98	.481
26	4.48	.276	47.90	.861	2.39	.177	45.56	.867	40.97	2.62	6.97	.248
27	4.67	.102	48.25	.291	2.29	.219	45.96	.510	42.09	.495	2.64	.102
28	4.84	.147	47.65	.267	2.83	.147	44.82	.219	39.12	.437	2.37	—
Overall Avg.	4.24	.456	48.01	.531	2.11	.357	45.91	.750	41.27	1.98	2.91	.466

Note: (1) Calculated from primary total P_2O_5 results.

Take a good look at your multiwall bag!

Like women's bathing suits, multiwall bags also reveal the passing of time.

Is your bag a vivid, modern example of your business vitality . . . or is it dull, drab and lacking in appeal?

Is your bag the ideal package for your product, in size and construction, or is it a carry-over from the past?

To compete successfully in your markets, your package should be as up-to-date as this issue of the magazine . . . *if it isn't*, it's a good idea to send for us.

KRAFT BAG CORPORATION

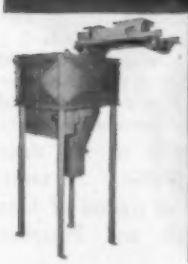
Gilman Paper Company Subsidiary

630 Fifth Avenue, New York 20, N. Y.
Daily News Bldg., Chicago 6, Ill.

Plants at St. Marys, Georgia and Gilman, Vermont
Sales Agents for The Kraftpacker

gilman PAPER CO.
• St. Marys Kraft Corp.
• Container Corp. Div.
• The Coldwell Corp.
• Kraft Bag Corp.

Dependable as a service for 3 generations



The Newest
KRAFTPACKER
will handle practically any free-flowing material—faster—and with more accuracy, than any open mouth bag filling machine of its type in use today—regardless of price!

☐ We are interested in improving our bag.
☐ We are interested in your Kraftpacker.

NAME OF COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____ PRINCIPAL_____

PRODUCT MFD._____ AC

LISTENING POST

By Paul Miller

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Epidemics and Identification Section, Horticultural Crops Research Branch, United States Department of Agriculture, Beltsville, Maryland.

Control of Fusarium Wilt and Root-Knot Nematode of Tobacco

O. D. Morgan, of the Maryland Agricultural Experiment Station, reports* that Fusarium wilt of tobacco, caused by the fungus *Fusarium oxysporum* var. *nicotianae*, has been generally present for many years in the five southern tobacco counties of Maryland. In recent years the wilt has been associated with root-knot nematodes, *Meloidogyne* spp. The species most commonly found has been M. *incognita* var. *acrita*.

In Maryland, Fusarium wilt is controlled almost exclusively with the resistant Robinson variety. Some growers practice rotation in addition to growing the resistant variety. Since growers practice rotation in addition to growing the resistant variety as soon as Fusarium wilt appears in their fields, a field heavily infested with the wilt organism is difficult to find. During 1953 a fumigation test for control of root knot on four truck crops and on tobacco was conducted in the Glen Burnie area. EDB *(ethylene dibromide)* was used in the test. It was observed that the untreated check tobacco had Fusarium wilt while the treated tobacco was not affected.

Since it was evident from the Glen Burnie test that wilt control followed fumigation for root-knot nematode, two additional fields with the Fusarium wilt-root knot complex were located, both in the Bryantown area of Charles County.

The study reported was conducted to determine whether or not root-knot nematode control would be a factor in the control of Fusarium wilt when soil fumigants D-D or ethylene dibromide were used.

Experimental Work: Three fields were used in the tests: Field 1 with ⅛ acre in the Glen Burnie area, and Field 2 with ½ acre, and Field 3 with 2 acres in the Bryantown area. Fields 1 and 2 were fumigated with EDB (Dowfume W-85) only. Field 3 was treated with EDB and D-D and is the test with which this study is primarily concerned. EDB was used at the rate of 5 gallons to the acre and D-D at 20 gallons to the acre.

The broadcast method of application was used in all fields. The equipment consisted of 8 injection tubes attached behind narrow cultivator shoes, at 10-inch centers and mounted on a cultivator frame. The injector tubes were attached to bronze fittings containing calibrated discs and fine screens. The bronze fittings were attached to a pressure gauge, then to a pump run from the power take-off of the tractor. The pump was connected to the tank containing the fumigant. All connections were brass, iron, or rubber tubing.

Field 1 was treated May 3, 1953, with EDB at 5 gallons to the acre. The tobacco plot was about ⅛ acre consisting of 3 rows treated and 3 rows untreated, each 320 feet long. Tobacco was planted during the first week of June. The winter cover crop for Field 1 was wheat and vetch. The vetch was heavily infected with root-knot nematode at the time it was plowed under in April.

Field 2, in the Bryantown area, in 1954 was heavily infested with root-knot nematode and badly damaged with Fusarium wilt in one section. The cover crop during the winter was wheat. Although no actual count was made of the wilted plants, it was estimated that 50 percent of the plants had Fusarium wilt in the infested area.

The area of Field 2 affected by the Fusarium wilt-root knot nematode complex in 1954 was divided into two 7-row plots. Each row was 420 feet long. Seven rows were broadcast-treated the first week in May 1955, about 40 days after the field was plowed, and 7 rows were left untreated. Data were taken from the 5 inside rows of the treated and untreated plots.

Field 3 in the Bryantown areas was found, in 1953, to be heavily infested with root-knot nematode and 35 percent of the plants had Fusarium wilt. Eight weeks after harvest of the 1953 crop, the soil was treated. After treatment, wheat and vetch were planted as a cover crop. A check of the field in April showed a good crop of wheat and vetch, even though they were sowed late.

The area was marked off in plots 40 x 100 feet; 5 treatments were replicated 3 times, at random, making 15 plots in all. The plot area was divided into 2 sections separated with a 25-foot untreated aisle. The entire area used was about 2 acres. The treatments were EDB at 5 gallons per acre; EDB at 2.5-2.5 gallons per acre in a split treatment, 2 weeks apart; EDB at 5-5 gallons split treatment, this last was not completed and it was not used. D-D at 20 gallons to the acre and untreated controls were included. Treatments were made November 3 and the split treatment again on November 17. The cover crop was plowed under the following April and tobacco was planted the last week of June.

The three fields were treated at soil temperatures over 50°F and air temperatures over 70°. The Catterton variety susceptible to both Fusarium wilt and root knot was planted in all three fields.

Near the end of the growing season, Fusarium wilt counts were made in each of the 3 fields. All plants of Field 1 were cut and housed. One hundred plants were harvested at random from treated and untreated plots in Fields 2 and 3. Plants from each field were put on sticks, tagged ,housed, stripped, graded, weighed. Following harvest, 25 root samples were made from each treatment in Fields 1, 2 and 3 and indexed for root knot. Soil samples of 250 grams each were also taken from all plots in each of the 3 fields and checked for root-knot nematode numbers.

Results: Results of the three tests are shown in Table 1. All treatments gave excellent control of both root-knot nematode and Fusarium

*Morgan, O. D. Control of Fusarium wilt and root-knot nematode of tobacco with soil fumigants. Plant Dis. Reptr. 41: 27-32. 1957.

Because Vulcan stocks the widest selection of Hi-Bake lined pails possible, manufacturers of chemicals, foods, drugs, oils, fertilizers, paints, varnishes and other hard-to-hold products have turned to Vulcan. They find Vulcan's years of experience coupled with constant field and laboratory research invaluable in solving their lining problems.

Do what so many others have done . . . bring your lining problems to Vulcan *first*. Let Vulcan's chemists lining-test your product. They will develop a Hi-Bake lining that will meet your most rigid specifications . . . one that will protect and maintain the quality and uniformity of your product. It will pay you in time and money saved.

Samples gladly supplied on request. Call or write today.

Over 40 years Container Experience

VULCAN
CONTAINERS INC.

Bellwood, Illinois
(Chicago Suburb)
Phone Linden 4-5000

In Canada:
Vulcan Containers Ltd.
Toronto 15, Ontario

Representatives in all
principal cities
See "Pails" in Classified
Phone Directories

wilt. Of the treatments, EDB at 5 gallons to the acre in Fields 1, 2 and 3, and 2.5 gallons split treatment in Field 3 gave best results, followed by D-D, and control.

The untreated area of Field 1 had a light infection of Fusarium wilt, while the treated area had no wilt where fumigant EDB was used. Wilt has never been bad in this area even though root-knot nematode infection was very heavy. In Field 2, Fusarium wilt and root knot were severe. In the treated plot of Field 2 where both root knot and Fusarium wilt were present, 12 percent of the plants had wilt, and 4 percent of the plants were killed. In the untreated plot only 11 percent of the plants survived in the 5 rows used in the data. Many plants died early and the plot grew up in weeds. The roots were rotted and nematodes had left the area. A soil check for the nematodes indicated that there were more in the treated than in the untreated plot of Field 2.

Table 1. The effect of soil fumigants ethylene dibromide (Dowfume W-85) and D-D on percent wilt, root knot index, yield, and nematode population in soil.

Field	Treatment	Percent wilt at harvest	Root† knot index at harvest	Weight of†† cured tobacco lb/A	Percent increase of weight over control	Nematodes in soil at harvest
1	EDB 5 gal/A	0	1.92	1391	87.7	heavy
	Control	5.82	4.01	741		heavy
2	EDB	12	2.44	525	600.0	heavy
	Control	89	4.44	75		moderate
		**	**	*		
3	EDB 5 gal/A	2.93	1.71	809	79.4	moderate
	EDB 2.5 gal	**	**	*		
	split/A	2.72	1.91	764	69.4	moderate
		**	**			
	D-D 20 gal/A	6.22	3.13	652	44.5	abundant
	Control	22.3	4.40	451		heavy

*: Significant at 5% over control.
**: Significant at 1% over control.
†: Index based on 1 = no infection to 5 = very heavy infection.
††: Weight in field 1 based on 5800 pounds per acre, in fields 2 and 3 based on 6000 pounds per acre, corrected for loss due to dead plants.

Field 3 showed a significant difference in amount of wilt in favor of treatment but not between treatments. Table 1 shows that with D-D, nearly twice as much wilt resulted as from either of the EDB treatments. Also, the root knot index was higher in the D-D plots than in either of the EDB treatments, which may account for the higher incidence of Fusarium wilt. The indexes of the control, D-D, EDB at 5 gallons, and

Escambia Chemical, a Bright, New Name in Nitrogen

"BAY-SOL" NITROGEN SOLUTIONS

ANHYDROUS AMMONIA

AMMO-NITE AMMONIUM NITRATE FERTILIZER—33.5% NITROGEN

MORE IN SERVICE, MORE IN QUALITY

Technical service field representatives, to aid you with any problem, are as near as your telephone.

Modern, easily accessible manufacturing plant and continuing research.

Conveniently located service offices.

Strong supporting advertising in newspapers, farm magazines and other media.

Manufactured by

Escambia Chemical Corporation
Pensacola, Florida

Distributed Exclusively by

Ashcraft-Wilkinson Company
Atlanta, Georgia

DISTRICT OFFICES: Norfolk, Va., Charleston, S. C., Tampa, Fla., Jackson, Miss., Montgomery, Ala., Columbus, Ohio, Des Moines, Iowa.

EDB 2.5 gallons split treatment are 4.40, 3.13, 1.71, and 1.92 respectively. The control index of 4.4 is significantly greater than the treatments. The percentages of wilt for D-D, EDB at 5 gallons and EDB at 2.5 gallons spilit treatments, and control were 6.22, 2.93, 2.72, and 22.3 respectively. All the plants in the treatments lived whereas 8.7 percent of the control plants died and were not harvested. This gives further evidence of severity of wilt in control over treatments.

Total weight of cured tobacco in the 3 fields was definitely in favor of treatment with soil fumigants. In Field 1, where wilt was light, the increase in weight was due to the control of root knot, whereas in contrast to this, in Field 2, the weight increase was due to control of the root knot-Fusarium wilt complex. Increases in yield for Fields 1 and 2 were 87.7 percent and 60.0 percent respectively. In Field 3, the increase in weight of treatments over control shows EDB at 5 gallons best, with 2.5 gallons split treatment next, and D-D treatment last; 79.4, 69.4, and 44.5 percent respectively.

The root knot index and the large number of nematodes found in the soil at the end of the season indicate a rapid build-up of nematodes at the end of the growing season. A check of nematode populations outside the plot areas of Field 3, where no tobacco was planted, gave a moderate number of root-knot nematodes, about the same as in the treated plots at the end of the season. Most of the wilt occurred in the last 3 weeks of the growing season. This was particularly true in Fields 2 and 3.

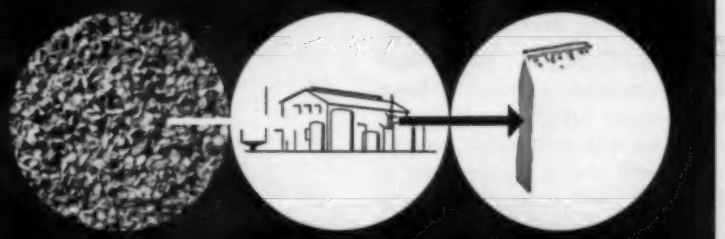
The 1956 Fungicide Tests (part 3 of which appears on pages 62-65) are being made up as a reprint and will be available late in April. Orders for the complete report may now be placed with Dr. D. A. Roberts, Cornell University, Ithaca, New York.

The booklets sell for $1.00, and will be sent postpaid if check accompanies order.

MIN CHEMISTRY *at work*

case:

How Granular Attaclay® helps you to manufacture...and market



M & C—looking ahead—offers a granular carrier that *helps you market more effectively* in this attractive but competitive field.

Granular Carrier Report: Specific *marketing* advantages include:
(1) Ultra uniform particles; (2) clean-cut premium appearance; (3) no caking in storage; (4) excellent poison release properties, no clog or waste, easy to apply, reduced costs to the grower; (5) what's in *your* bag is the *known, trusted* product of the major *original* supplier of granular carriers.

Specific processing advantages:
(1) Ideal properties, highly sorptive, works well with toxicants, resists breakdown; (2) easy to formulate and package; (3) across-the-board use in pesticides, herbicides, fungicides, soil fumigants.

Going Granular? We're geared to supply nature-given *process-engineered* materials that will ease production and aid sales. Use the coupon.

MINERALS & CHEMICALS CORPORATION OF AMERICA
349 Essex Turnpike, Menlo Park, N.J.

I'm interested in a natural mineral product for_____

Send: ☐ Detailed "agchem" literature ☐ Free samples

name_____ title_____

company_____

address_____

city_____ zone_____ state_____

For more data, see Chemical Materials Catalog Pages 330-334

MINERALS & CHEMICALS
CORPORATION OF AMERICA
349 Essex Turnpike, Menlo Park, N.J.

Leaders in creative use of non-metallic minerals
ATTAPULGITE (*Attapulgus*)
ACTIVATED BAUXITE (*Porocel*)
KAOLIN (*Edgar • ASPs*)
LIMESTONE (*Chemstone*)
SPEEDI-DRI FLOOR ABSORBENTS

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head — Plant Pest Survey Section, Plant Pest Control Branch, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the U. S.

By Kelvin Dorward

Chinch Bug Survey Results

RESULTS on the State-Federal cooperative chinch bug hibernation survey have been released. As in the case with most insects, weather factors will play a decisive part in the initial 1957 infestation of this corn and small grain pest. Indications are, however, that the number of bugs going into hibernation in northeastern Arkansas is sufficient to have a potential of a very severe infestation. This infestation extends into southeastern Missouri or the "bootheel area." Northeastern Oklahoma has a hibernating population rating from moderate to severe. The west-central portion of Missouri shows a rating of very severe with the northern half of the State mostly moderate to severe with several counties carrying a very severe rating. The potential for Kansas is down from 1956 with ratings from light to severe all in the eastern part of the State. All ratings for Iowa were in the southern fourth of the State and were predominantly light. A few counties showed a moderate rating with only two counties showing severe. The Illinois situation appears to be comparable with 1956, with the infestation tending to be in the central part of the State. Northern Indiana potential indicates a moderate infestation for 1957 with perhaps more acreage involved than in 1956.

Insect Activity On Increase

WITH the approach of spring insect activity is on the increase over a wide area of the country. Although **armyworm moths** have been taken in light traps in some of the southern states throughout the winter, Louisiana by late February was reporting light populations of armyworm larvae in East Baton Rouge, St. John the Baptist, St. Helena and Tangipahoa Parishes. Counts in small grain ranged from one to seven per 100 sweeps of the net with the size ranging up to the fifth instar. The army cutworm was active in Oklahoma with averages of about three larvae per square yard for most small grain fields in Kingfisher County and up to 6 per square yard in Major County.

Heavy infestations of the **glassy cutworm** were causing localized damage in Merion bluegrass seed fields at Tehachapi, Kern County, California. The pests were not responding to treatment which in some cases had cost up to 75 dollars per acre.

The **winter grain mite** in early March was recorded as being medium to heavy on small grain in Van Zandt and Kaufman Counties, Texas. Similar infestations were reported from the Dallas-Ft. Worth area and in a localized area of Robertson County. The **brown wheat mite** was fairly uniformly scattered over several Oklahoma counties, but there were no reports of damage.

Pea aphids were reported on alfalfa from Georgia, Louisiana, Illinois and Arizona. Treatment was necessary for the **spotted alfalfa aphid** in some alfalfa fields in the Yuma Valley of Arizona. This aphid was on the increase in Clark County, Nevada, and heavy populations were recorded in Brazos and Burleson Counties, Texas. The remaining counties in Texas reporting the spotted alfalfa aphid recorded light infestations. The same was true for counties reporting in Oklahoma, Louisiana and Georgia.

Among the truck crop insects, the **vegetable weevil** was one of the most prominent in late February and early March. In Georgia the pest was causing moderate to heavy damage to crucifers generally over the State. Reports of localized damage were received from North and South Carolina. Mississippi also reported the pest. Other vegetable pests causing concern were the **cabbage looper** in Texas where controls were required in the lower Rio Grande Valley and the **green peach aphid** in California where infestations were heavy enough to require the plowing up of some spinach fields in Orange County. Aphids were also causing damage to untreated cabbage and brussels sprouts in the lower Rio Grande Valley of Texas.

A recent survey of the **beet leafhopper** situation in the western and southwestern part of the United States would indicate that the expected movement from the desert breeding grounds into the cultivated districts of north and south central Utah and western Colorado is expected to be light. The movement to southern Utah, southern Nevada and central Arizona is expected to be moderate.

In late February, tobacco plant beds in parts of Georgia were infested with light to moderate populations of the **green peach aphid,** the **vegetable weevil** and the **tobacco flea beetle.**

The first **cotton insect** condition report received from the lower Rio Grande Valley of Texas indicated that with favorable weather conditions, insects should be less destructive this season than usual. The excellent clean-up practiced in the fall of 1956 being largely responsible. Some cutworm damage to cotton, however, has been reported in the San Benito and Los Fresnos areas. The fields concerned were planted to vegetables or were trashy during the winter. A build-up of fleahoppers was reported from one field northeast of Raymonville which had been planted early. Treatment of the field would be necessary if the population increased.★★

Fertilizer Views and News

By Vincent Sauchelli

Grade reduction on new basis

THE number of permissible fertilizer grades in every state is admittedly excessive. This has been recognized for years by industry and research agencies. Many proposals have been advocated on how to reduce the number; but, except in those states where restrictions are by statute, little progress has been made. The problem is complicated because of the many conflicting interests,—commercial as well as agronomic. A simple, persuasive plan for doing the job has been given the industry by Frank E. Boyd, an industry agronomist, residing in Alabama. It deserves careful study by all who are earnestly interested in reducing the grades.

Mr. Boyd surveys the situation prevailing throughout the South, and concludes that three basic fertilizer ratios with matching fertilizer grades suffice for most of the soils and crops of the region. He points out that in the interpretation of the results of a soil test, the agronomist does not pin-point his recommendations of plant nutrients. For example, he reports available phosphate as "low," meaning anything below 50 pounds of P_2O_5 per acre; or "medium," meaning 50 to 100 pounds; or "high," any amount above 100 pounds. To meet most soil and crop needs, the recommendation can be made on the basis of any one of three basic ratios which he specifies as follows: 1:1, 1:2 and 2:1 (P:K). A review of current fertilizer ratios throughout most of the country reveals that nitrogen is the element in fertilizer grades that most often fluctuates widely from zero upward, whereas phosphorus and potassium are more or less stable. Hence, the suggestion is made that a system of fertilizer recommendations may be established by first setting up the series of P:K ratios as noted previously, and then adjusting the nitrogen as the soil test may require. The nitrogen may be varied with an equal P:K ratio, or a high P low K, or a low P high K, ratio.

Because most crops require relatively more nitrogen than the other nutrients, it is not always economical to apply the total requirements of this element in the mixed fertilizer: in the nitrate form nitrogen leaches readily from the top soil zone. The general management practice is to apply it either before, or at the time of, or after planting, either mixed with the other nutrients, or as a simple side-dressing material.

It is interesting to observe that most of the ratios prevalent in all regions of the country follow the pattern of the three basic P:K ratios with fluctuating amounts of nitrogen. However, industry seems to be overdoing the number of grades per ratio group. For example, in one state picked at random, we find 6 grades of the 1-1-1 ratio. By manufacturing only the proposed three basic P:K ratios, with 2 to 4 grades per group, industry could simplify its production and storage problems,—and the farmer would benefit also.

Fertilizer Equipment Problems

COMPLAINTS are heard from all parts of the country that current fertilizer applicators are, generally, inadequately suited to do the job. Farmers criticize the implement manufacturers for failing to realize and satisfy their specific needs: for example, more efficient equipment for applying today's free-flowing, higher-analysis fertilizers. The higher and faster rate at which fertilizers are being applied at present with tractor-drawn equipment makes the ordinary fertilizer distribution boots obsolete. The boots are designed for a lower speed application.

It is well-known that many agricultural experiment station extension services have held back on making specific recommendations, because they feel few farmers are equipped with distributors capable of placing fertilizer as it should be put down. This criticism of the non-suitability of distributors applies not only to corn planters but to drills for making meadow seedings and other similar equipment.

The reason commonly heard in defense of the equipment manufacturer is that most farmers do not know what they really need. Since a change in design means costly retooling, and since present equipment is being purchased, manufacturers, it is said, do not take the initiative in making new implements. This situation will not change much until sufficient pressure is brought to bear on the manufacturers by the local agricultural college authorities and farm organizations.

Farmers feel that most equipment available at present is not designed for proper planting: the press wheels and furrow openers do not do a proper job; the planters do not plant to a uniform depth, nor prop erly compact the soil around the seed. Illinois and Missouri farmers have reported considerable damage to germination of corn seed caused by the split-boot type of applicator which places the fertilizer above the seed or tends to mix it with the seed.

Keep Your Garden Green and Clean

Niagara

LEAF-GREEN pomo-green

DUST OR SPRAY

FOR ROSES

and ornamentals

BLENDS WITH FOLIAGE!
LEAVES NO
UNSIGHTLY RESIDUE

The Green Colored Combination Insecticide-Fungicide

Foliage green Pomo-Green is all you need to grow beautiful blooms. Just dust or spray at regular intervals with this green colored, water soluble powder. It will keep your rose garden, other flowers and ornamentals free from blight, mildew, black spot, aphids and other harmful pests. Contains two insecticides, a miticide and two fungicides for complete control.

Pomo-Green coats the foliage with a natural colored film of protection. There's no objectionable black or white cast to mar the beauty of your garden. Get Pomo-Green today in canisters or handy push-pull dusters—at hardware, seed, nursery and garden supply stores.

OTHER NIAGARA AIDS TO GOOD GARDENING

Multi-purpose pesticide for flowers and vegetables.

Insecticide-fungicide for all "back yard" fruit growers.

Protection for all your evergreens and shrubs.

Protects tomatoes and potatoes from bugs, blights.

An effective insecticide for garden, lawn and home.

***FREE* Dust and Spray Guide!**
Ask your dealer for a copy—or write us.

Niagara GARDEN PRODUCTS
Niagara Chemical Division
Food Machinery and Chemical Corp. Middleport, New York

Higher analysis fertilizer is rapidly replacing lower grades, and this fact makes it imperative to avoid the split-boot applicator: correct placement of concentrated fertilizer in relation to the seed will eliminate fertilizer-caused germination losses.

Although placement of fertilizer is only one phase of the broader subject of fertilization, correct placement is an integral part of the profitable fertilization of crops. Methods of applying a fertilizer should always be considered at the time the fertilizer is being chosen for a particular crop. Implement manufacturers share heavily in the responsibility of how efficiently the fertilizer is utilized on the farm.

Soil—Two Aspects

ASK some of your friends to tell you what soil is. Quite probably, if the persons are not familiar with agricultural science the answer will be, "it is plain dirt." Most people regard soil as so much dead earth. To them the fact is unknown that soil is alive, a wonderful cosmos in itself teeming with life, ever changing, chemically and biologically transmuting compounds that provide sustenance to myriads of species of plants. All over this globe, wherever climate is propitious, the invisible alchemy of the soil never ceases to enrich the otherwise inert dirt with nutrient elements needed by the microbial flora, the hungry roots of plants, and the many forms of insect life residing within it. In Greek mythology, earth was called the All-Mother. No, Mother Earth is not the dead, inert debris of rock materials; it is a very active chemical factory, which directly and indirectly influences the health and well-being of you and me.

Let us consider, briefly, soil as the agronomist or soil scientist sees it. It is made up of many chemicals of which silicon dioxide (white sand) makes up in some type about 75 percent of the total, followed in rank by aluminum oxide, and iron oxide. The other constituents are the oxides of calcium, magnesium, sodium, manganese, potassium, phosphorus, sulfur, titanium, nitrogen. The chemist generally reports the analysis of the soil in terms of the oxides of the elements, although most of the constituents are complex mineral compounds. As for the microbial population, bacteriologists have counted as high as 4 billion bacteria in a thimbleful of soil. These organisms decompose the organic matter,—and in the process make many nutrient elements available to crops.

We must think of soil as the basis of our agriculture, the medium in which we grow our food, fiber and fodder crops. In some parts of the world including our country, some soil areas are unable to maintain crop life owing to the presence or absence of certain chemicals essential to living organisms. In the Ninety Mile Plain of South Australia, for example, only stunted scrub would grow until the scientists found that by applying small amounts of copper and zinc salts with generous amounts of phosphorus (as superphosphate) the same soil could be transformed into one capable of supporting excellent forage for profitable sheep raising. In England and other countries the application of magnesium to the soil has eradicated the cattle disease known as hypomagnesaemic tetany or "lactation tetany." In Wyoming and Montana the presence of selenium in the soil indirectly destroys the hooves of cattle which graze the forage growing on these seleniferous areas. And so it goes. Where normal supplies of essential minerals abound, there crop life flourishes and agriculture is profitable. Such soil is healthy and needs only water to produce abundant crops of nourishing food. Luckily, modern soil science is able to detect and remove soil evils that adversely affect agriculture and restore such soil to man's profitable use.

Chlorine: Essential Plant Nutrient

SEVEN elements have been added to the list of essential plant nutrients since the classical studies of Julius Sachs and W. Knop in the 1860's. Up to that time plant physiologists listed 10 different chemical elements as the total needed for growth, development and reproduction of the higher plants: nitrogen, phosphorus, potassium, magnesium, calcium, oxygen, hydrogen, carbon, sulfur and iron. Among these iron must be considered as the first micronutrient or trace element known to be indispensable. During the past 50 years, scientists have slowly established the essentiality of six additional micronutrients in the following order: manganese, in 1915; boron, between 1923 and 1927; zinc, between 1928 and 1932; copper, in the early 30's; molybdenum in 1942; and the latest, chlorine — which was proved conclusively as essential by T. C. Broyer and associates in 1954.

Why was the discovery of the essential role in plant physiology of these micronutrients so long delayed? That is a good question. It has a good answer. The chemists did not have analytical methods or techniques sufficiently sensitive for the purpose. Plants, it seems, have the habit of absorbing every inorganic material within the root zone. Much extraneous material thus gets into plants and carries over into the sample when the plant substance is ashed preparatory to the chemical analysis. Silicon and aluminum are conspicuous in this respect, since they comprise the bulk of mineral soils and are dissolved to some extent in the soil solution. The scientists succeeded in proving the present accepted group of micronutrients as essential only after they learned how to purify plant growth, culture solutions and eliminate sources of contamination. For example, seeds of plants, water for irrigation, the containers used for holding the culture solutions and even the atmosphere became recognized as potential sources of contamination with the refinement of analytical methods. The chemical reagents used in making up the solutions had to be purified to an extremely high degree before they could be used. Not until the techniques of microchemistry were sufficiently developed in the early 1930's was it possible to determine the presence

(*Continued on Page* 117)

DOES YOUR LINE OF FORMULATIONS INCLUDE
BOTH OF THESE BIG-MARKET INSECTICIDES?

Parathion

and

You can get both from Monsanto and offer growers proved, low-cost control of:

- RESISTANT BOLL WEEVIL IN COTTON
- SPOTTED ALFALFA APHID
- YIELD-REDUCING CITRUS PESTS

Methyl Parathion

Methyl Parathion . . . recommended for sure weevil control. While boll weevil is showing resistance to some insecticides that *used* to do a good job, Methyl Parathion offers full, *complete* control. It also controls cotton aphid, some species of spider mites, cotton leaf perforator, cotton leaf worm. Formulates into dusts, wettable powders and emulsifiable concentrates.

Parathion for citrus pests. Only Parathion controls all these citrus pests at lowest cost per acre:

citricola scale	yellow scale
cottony-cushion scale	aphids
purple scale	little fire ants
California red scale	mealy bugs
	orange tortrix
	plant bugs
	thrips

Parathion for spotted alfalfa aphid: Only Parathion and community-wide spray programs can combat the insect pest that has caused a loss of over $80,000,000 in alfalfa production in the three-year period, 1954 through 1956.

For more information about either Parathion or Methyl Parathion write:
Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Dept. AG-1, St. Louis 1, Missouri

MONSANTO®

BACTERIAL SPOT AND SCAB

In comparing a dozen materials applied twelve times to five year old peaches, in North Carolina, Clayton reports best control of bacterial spot with sulfur + Streptomycin. The next best treatments seemed to be captan + Agristrep, and wettable sulfur + Agrimycin. Scab was held down on fruit by most of the materials used. (Table 22 and 23.)

LEAF CURL

A single fall application of five fungicides, November 25 at St. Catharines', Ontario by Chamberlain resulted in satisfactory control with Elgetol, ferbam, and Bordeaux which are recommended over Phygon or COCS. (Table 24.)

TABLE 24.

Control of Peach Leaf Curl in Ontario From One Fall Application (61)

Fungicide	Rate/100 Imp. Gal.	Exp. Pref.
Ferbam	2½ lbs.	2
Phygon XL	1 lb.	5
Elgetol	½ per cent	1
COCS	4½	4
Bordeaux	8-10	3

Peach

Leaf curl was controlled in Pennsylvania with a number of materials even when applied just after a few buds had cracked. Fermate at three pounds gave good control as did Bordeaux, Elgetol, lime sulfur, Puratized and captan, but glyodin, Dithane Z78, and Fermate at two pounds, were significantly poorer than other treatments. (Table 25)

Citrus

PHYTOPHTHORA BROWN ROT

At Ventura, California, Calavan found the two best fungicides for one application to be a tank mix $ZnSO_4$ + $CuSO_4$ + lime or a similar 3-4½ Bordeaux mixture. All nine fungicides were satisfactory though somewhat phytotoxic, except Captan 50W but this gave poorest control. However, it is recommended in a two spray program while the two above tank mixes are recommended as a single application, made before the winter rains. (Table 26).

CITRUS SCAB AND CANKER

A nursery of infected mandarin orange seedlings was divided into repli-

TABLE 22

Fungicidal and Antibiotic Sprays and Dusts For The Control of Bacterial Spot and Scab on Five Year Old Elberta Peaches at Jackson Springs, N. Car. (35)

Fungicide	Lbs./100 g	Bacterial Spot % Lvs. Infected June 5	Bacterial Spot Index (0-100) on Fruits Aug. 8	Scab Index (0-100) on Fruits Aug. 8
Vancide Z-65	2	54	50	3
Vancide Z-65 + Kolospray	1 3	62	51	5
Manzate	2	62	56	8
Thylate	2	63	59	6
Phybam-S	4	59	50	13
Kolospray	6	57	53	8
Wettable sulfur + Agrimycin	6 9.34 oz.	46	36	6
No. 1563	1½	63	64	38
Captan (50%)	2	60	54	4
Captan (50%) + Streptomycin dust	2	57	50	4
Captan (50%) + Agristrep (100 ppm)	2	41	28	3
No fungicide		61	40	74

1956 FUNGICIDE TESTS

(Part 3)

TABLE 23

Demonstration Test No. 2 (35)

Fungicide	Lbs./100 g	Bacterial Spot % Lvs. Infected June 5	Bacterial Spot Index (0-100) on Fruits Aug. 8	
Sulfur	6	46	31	—
Sulfur + Streptomycin 100 ppm		24	17	—
Sulfur + Streptomycin 100 ppm except 300 ppm in first three sprays		24	20	—

TABLE 25

Control of Peach Leaf Curl in Pennsylvania (44)

Materials	Rate per 100 gal.	Curled lvs. per 15 terminals
Bordeaux	6-6-100	0.0
Elgetol	1 qt.	.1
Fermate	3 lbs.	.1
L—S	6 gal.	.7
Puratized A S	1 pt.	.9
captan	2 lbs.	1.4
Bordeaux	2-3-100	2.0
Fermate	2 lbs.	9.6
Dithane Z78	2 lbs.	10.5
glyodin	1½ qt.	14.
Unsprayed checks		123.0
	LSD	9.17 and 12.15 (5 and 1%)

TABLE 26

Control of Phytophthora Brown Rot of Citrus in California (4)

Fungicide	Lbs./100 Gal.	Control Rating	Exper. Pref.
Bordeaux mixture	3—4½	1	2
$ZnSO_4 \cdot H_2O$ + $CuSO_4 \cdot 5H_2O$ + hydrated lime	3—2—6	2	1
22% Cu Bordeaux	3	7	5
Bordeaux mixture (12.7% Cu)	6	4	4
Alcufe	8.4	6	5
Ortho Cop 53 + hydrated lime + Multifilm spreader	1½—1½—¼	8	5
Microgel	1.5	5	5
Robertson fungicide + hydrated lime	¾—2¼	3	3
Captan 50W	2	9	6

TABLE 27

Citrus Scab Control—Nursery in Philippines (65)

Fungicide	Conc.	Mean spots per plant 10 Apples. +TOX	+MAL	+BHC	TOTALS
Cu_2O	1 lb.	6	7	10	23
3-3-50		8	9	8	25
L-S	1-64	33	45	56	134
Check		99	99	99	297
	Totals	146	160	173	

TABLE 28

Citrus Canker Control—Nursery—Philippines (65)

Fungicide	Conc.	Mean Spots per Plant 10 Appls. +TOX	+MAL	+BHC	TOTALS
Cuprocide		.3	.7	.7	1.7
3-3-50		1.	1.	.9	2.9
L-S	1.64	3.	6.	7.	16.
Ck.		2.	2.	2.	6.
	Totals	6.3	9.7	10.6	

Meet The Demand For High Analysis

Use

DAVISON'S

TRIPLE

Superphosphate

State Agricultural Experiment Stations and other authoritative sources are recommending fertilizers with ever increasing plant food units per ton. High analysis fertilizers are in demand because they give more for each fertilizer dollar. Meet this demand by incorporating Davison's New Triple Superphosphate in your formulation.

Davison's Triple Superphosphate has 45/46% available P_2O_5 and is supplied in the easy-to-use granulated form or run-of-pile.

Order Davison's Triple Superphosphate. For complete information, call or write.

Progress Through Chemistry

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

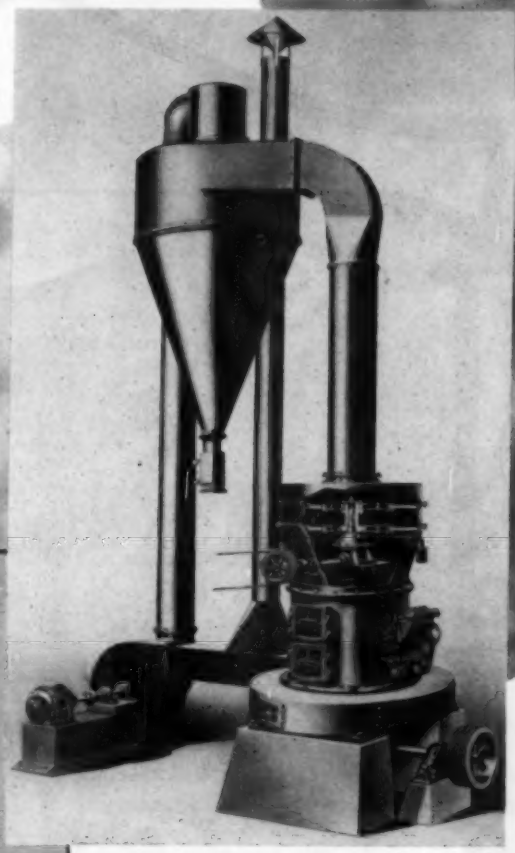
Baltimore 3, Maryland

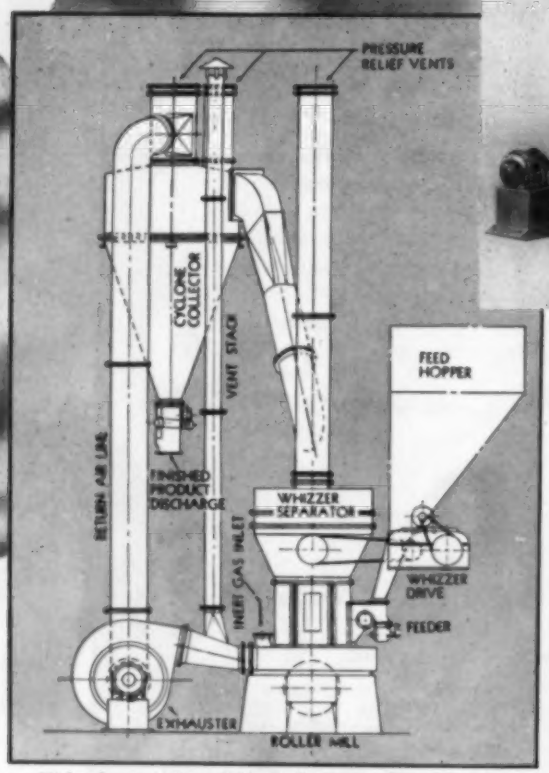
PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, TRIPLE SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS AND SILICOFLUORIDES. SOLE PRODUCERS OF DAVCO® GRANULATED FERTILIZERS.

SULPHUR GRINDING

with the RAYMOND *Whizzer-Equipped* ROLLER MILL

CLEAN, SAFE
DUSTLESS
AUTOMATIC
ECONOMICAL





Write for new Insecticide Bulletin No. 84, which describes application of the Raymond Roller Mill and Imp Mill to sulphur bearing formulations and other insecticides.

Production of powdered sulphur is a critical grinding operation. The modern Raymond Roller Mill is recognized as the standard unit in this field since it has special features built into it, which provide a safe, economical, trouble-free method for handling this sensitive material.

Mill system is continuously blanketed with inert gas that does not support combustion.

Piping and collectors made of extra heavy gauge sheet steel with relief vents on mill and cyclone collector.

Oil journals specially designed for sulphur grinding.

Special valves for discharging material from the cyclone collector with a minimum of air leakage.

Whizzer Separator operates perfectly in this safety system, and produces a superfine and uniform finished material at high finenesses and low cost.

COMBUSTION ENGINEERING, INC.

Raymond Division

1314 NORTH BRANCH ST.
CHICAGO 22, ILLINOIS

SALES OFFICES IN PRINCIPAL CITIES

Combustion Engineering-Superheater Ltd., Montreal, Canada

cated plots and sprayed ten times at weekly intervals with copper, ziram, and sulfur fungicides at Los Banos, Philippines. Lime sulfur was ineffectual compared to the coppers against both diseases and caused some burning at 1-64. Zerlate controlled scab well, but not canker, at least in the wet season. Bordeaux or cuprous oxide were better, according to Nora and Newhall. (Tables 27 and 28 and 29)

TABLE 29
Citrus Scab Control in Nursery—Wet Season—Philippines (65)

Fungicide	Conc.	Disease
Check		165
Gycop 53 (COCS)	4 lbs.	27
Zerlate	3 lbs.	8
3-3-50 Bordeaux		6
L.S.D	at 5% =	22

Coffee

RUST

In a replicated two year field comparison of several copper and organic fungicides in the Philippines, Orillo and Newhall found Bordeaux and cuprous oxide were much superior to any of the organics from the stand points of leaf spot (rust) control, leaf drop control, and total yield at the end of the second season. Lime sulfur and calcium sulfamate burn too badly to be considered. By the end of the second year, however, Manzate and Orthocide made a little better appearance. Better control from the coppers perhaps is due to their superior adherence as the spray intervals were approximately three weeks apart. (Table 30)

Small Fruits

Red Raspberries

POWDERY MILDEW

In the Portland area of Oregon only Karathane has given any satisfactory degree of control. Used at ¾ lb. per 100 gallons, this material does not cause appreciable foliage injury. Stronger solutions are caustic in hot weather. Sprays applied early in the season, to wipe out the initial infection and to protect against spread from these early infections, prevent most of the fruit losses but do not assure freedom from foliage infection later in the season. It is suggested that growers use this material, but more data on timing, and perhaps dosages are needed before making recommendations. Sulfur and Actidione also aid in control of mildew, but are too phytotoxic to be satisfactory, according to Vaughan. (42)

Strawberries

FRUIT ROTS

Either captan or ziram can be used and the results with these two materials are about equally good in Oregon. Four applications, (a) at the start of the blossoming period (b) when blossoming is completed (c) two weeks later and (d) just before harvesting starts will be recommended. Later applications will depend on the weather during the harvest season. Sprays are more effective than dusts. In either case 2.5 lbs. of active material per acre per application are employed. At these rates no burning or toxicity troubles result. Other materials have not given control. (42)

Grape

DEAD ARM

In field tests at St. Catharines', Ontario a number of fungicides and combinations thereof were employed by spraying at delayed dormant, again at the ¾ leaf stage, and once more after bloom. Bordeaux 5-5-50 and the captan analogues caused some burning and russeting. The first four in Table 31 were recommendable and the last three unsatisfactory, especially number seven.

Vegetables

Bean

POWDERY MILDEW

Of seven antibiotics tested as sprays at Beltsville by Zaumeyer for protection against powdery mildew, Anisomycin at 50 ppm was best with satisfactory control also from Griseofulvin at 100 ppm. The other five, all used at 100 ppm, were unsatisfactory. All were safe and the above two are recommended for grower trial. (Table 32.)

RUST

A comparison of six antibiotic sprays made in a greenhouse at Beltsville by Zaumeyer and Wester indicated that Anisomycin is a good protectant and eradicant at 100 ppm, while Oligomycin also gave satisfactory control at the same concentration. Griseofulvin at 440 ppm controlled but Mycostatin and Filipin at 300 and Rimocydin at 200 ppm were not satisfactory. The first three are recommended for field trials. None caused plant injury. (Table 33.)

TABLE 30
Coffee Rust Control in Philippines After the First Six Applications and After Two Seasons (16 appls.) (64)

Fungicide	Rate	% Rusted Leaves After 1st Season	2nd Season
Calcium sulfamate[1]	1-1-50	2	—
Bordeaux	4-4-50	4	—
Bordeaux	3-3-50	—	2
Cuprocide	1½ lbs.	18	6
maneb	2 lbs.	29	7
captan	2½ lbs.	32	8
Sulfur ferbam	1 lb.	38	—
C&C 6710	2 lbs.	—	13
Tersan	2 lbs.	46	—
ferbam	2 lbs.	—	21
Kolo (S + Phygon)	3 lbs.	55	—
C&C 7443[2]	2 lbs.	—	40
Check		53	30

[1]burned leaves off and retarded growth so eliminated
[2]incomplete program for lack of material.

TABLE 31
Control of Cryptosporella Dead Arm of Grape in Canada (61)

Fungicide	Rates	Order of Control	Exp. Pref.
DN289 + ferbam	.5%:2 lb.	1	1
DN289 + Bordeaux	.5%:5-5-100	1	2
L-S + ferbam	1-10:2 lb.	1	1
L-S + Bordeaux	1-10:5-5-100	1	2
ferbam	2 lb.	3	3
Bordeaux	5-5-100	2	3
Captan H6877 + Captan 877	2 lb.: 2 lb.	4	4

TABLE 32
Control of Powdery Mildew of Bean in Greenhouse Tests at Beltsville (19).

Anti-biotic	Conc.	Control Rating	Exp. Pref.
Anisomycin	50 ppm	1 S	1
Oligomycin	100 ppm	U	—
Griseofulvin	"	2 S—	2
Mycostatin	"	U	—
Filipin	"	U	—
Rimocidin	"	U	—
Streptomycin	"	U	—

TABLE 33
Control of Bean Rust in Greenhouse at Beltsville with Antibiotics (20).

Antibiotic	Conc.	Control	Exp. Pref.
Anisomycin	100 ppm	1	1
Oligomycin	100 ppm	1	2
Griseofulvin	440 ppm	S	3
Mycostatin	300 ppm	U	
Filipin	300 ppm	U	
Rimocydin	200 ppm	U	

TABLE 34
Control of Bean Anthracnose With Antibiotics at Beltsville (20).

Antibiotic	Rate	Control	Exp. Pref.
Anisomycin	200 ppm	U	—
Oligomycin	100 ppm	1	1
Griseofulvin	440 ppm	U	—
Mycostatin	450 ppm	S	2
Filipin	300 ppm	U	—
Rimocidin	200 ppm	U	—

ANTHRACNOSE

Six antibiotics were treated in Beltsville greenhouse by Zaumeyer and Wester as sprays. The two most satisfactory were Oligomycin at 100 ppm and Mycostatin at 450 ppm. All were safe at the concentration employed but Oligomycin. The two mentioned are recommended for grower trial. (Table 34.)

Lima Bean

ANTHRACNOSE

In a comparison of six antibiotics sprayed on beans once as a protectant in the greenhouse at Beltsville, Zaumeyer and Wester report only Oligomycin at 200 ppm was effective against stem anthracnose. The unsatisfactory materials included Anisomycin at 100 ppm, Griseofulvin at 440, Mycostatin at 300, Filipin at 200, and Rimocidin at 200 ppm. (20)

DOWNY MILDEW

In a similar test of the same antibiotics plus Streptomycin as a one application protectant, the same workers obtained the best control with Streptomycin at 50 ppm. Second best were Anisomycin and Oligomycin each at 100 ppm. Mycostatin also gave satisfactory control and was given third preference by the experimenters. Some phytotoxicity was observed with Anisomycin. (20)

RHIZOCTONIA STEM CANKER

Spraying a one to one mixture of PCNB (Terraclor) and captan, into the furrow at seeding time, gave excellent control in southern California, according to Kendrick and Paulus. The rate of application considered best, after eight field plot tests, was 1.5 pounds of each fungicide in fifteen gallons of water per acre of rows thirty inches apart. Due to high recuperative power of the large lima bean, yield increases from this in the furrow treatment may not occur unless the disease loss exceeds ten per cent in the checks or the seeding rate is low. A similar treatment using Dithane D14 and $ZnSO_4$ tank mix at the same rate in two fields gave unsatisfactory control. Both materials were safe on large limas but only the Terraclor-captan mixture is recommended and then as an insurance against inadequate stands. (3)

DOWNY MILDEW

Two field applications ten days apart with four materials made by Crossan and Lloyd in Delaware revealed manzate and tribasic copper superior to Streptomycin + glycerin or Streptomycin + copper. The tribasic caused slight phytotoxicity but the two better fungicides are being recommended. The antibiotic is not thought worthy of further trial. (Table 35.)

In another comparison by the same workers of six materials applied three times at weekly intervals, best results against mildew were secured with Manzate, Dithane D14 + Zn, and tribasic copper in that order. These three are recommended, though tribasic is sometimes phytotoxic, but tribasic as 7% dust, Tennam 7, and streptomycin sulfate at 100 ppm were unsatisfactory, particularly the last two. (Table 36.)

Long Island Report

Of eleven fungicides compared in small replicated field plots sprayed five times at weekly intervals on Long Island, Cetas preferred and recommends Manzate, Orthocide, Dithane D14, and Tribasic in that order. The four not thought worth further trial for this disease were Agrimycin 100, Omadine Mn. salt, Tennam 7, and Thylate. None was phytotoxic. (Table 37.)

TABLE 35
Control of Downy Mildew of Lima Bean in Delaware (6)

Fungicide and rate	Control Rating	Yield and Pref. Ratings
Tribasic copper sulfate — 4-100	2 — S	2
Manzate — 2-100	1 — S	1
Streptomycin + glycerine — 100 ppm + 1%	4 — U	4
Streptomycin + copper — 100 ppm + 1½ lbs.	3 — U	3

TABLE 36
Control of Downy Mildew of Bean With Three Weekly Applications in Delaware (6)

Fungicide and rate	Control Rating	Yield and Pref. Rating
Tribasic copper sulfate, 4-100	3 S	3
Tribasic $CuSO_4$ dust, 7%	U	4
Manzate, 2-100	1 S	1
Dithane D-14 + $ZnSO_4$, 2 qts.-¾ lb.	1 S	2
Streptomycin sulfate, 100 ppm	S	5

TABLE 37
Control of Downy Mildew of Lima Beans on Long Island (30)

Fungicide	Rate/100 g	Control Rating	Yield Rating	Exper. Pref.
Agrimycin 100	100 ppm	10 U	10	10
Dithane D14 + $ZnSO_4$	2 qt.-¾ lb.	5 S	7	3
Manzate	2 lbs.	1 S	1	1
Omadine, Mn. salt	2 lbs.	9 U	9	9
Omadine, Zn. salt	2 lbs.	7 U	6	7
Orthocide 50-W	3 lbs.	2 S	1	2
Tennam 7	2 lbs.	11 U	11	11
Tetradehydro analog of Captan	4 lbs.	3 S	3	5
Thioneb 50-W	2 lbs.	4 S	4	6
Tribasic $CuSO_4$	4 lbs.	6 U	8	4
Thylate	2 lbs.	8 U	5	8
None			12	12

TABLE 38
Pre-emergence Damping Off Control of Cucumber in Florida (12).

	Wgt/100 lbs. seed	Control Rating	Exper. Pref.
Orthocide 75 slurry	3 ozs.	4 S	3
Ortho Seed Guard slurry	3 ozs.	1 S	
Arasan dust	2 ozs.	6 S	2
Check		8 U	
Thiram + dieldrin dust	1.9 ozs.	5 S	
Terraclor spray*	3 lbs. active per acre	9 U	
Parzate spray*	2 lbs. active per acre	7 S	
Tersan spray*	5 lbs. active per acre	3 S	1
Semesan dust	5 ozs.	2 S	1

*Sprayed over seed in open furrow.

TABLE 39
Pre-emergence Damping Off Control of Bean in Florida (12).

Fungicide	Wgt./100 lbs. of seed	Control Rating	Exp. Pref.
Orthocide 75 slurry	2½ ozs.	1 S	1
Ortho Seed Guard slurry	2½ ozs.	6 S	
Arasan dust	2 ozs.	2 S	2
Check		7 U	
Spergon dust	3½ ozs.	3 S	3
Thiram + Dieldrin dust	1.9 ozs.	4 S	
Terraclor spray*	3 lbs. active per acre	9 U	
Parzate spray*	2 lbs. active per acre	8 U	
Tersan spray*	5 lbs. active per acre	5 S	

*Sprayed over seed in open furrow.

Arcadian® News

Volume 2 | For Manufacturers of Mixed Fertilizers | Number 4

Benefits of Calcium Sulphate in Ammoniated Superphosphate

FERTILIZERS CONTAINING GYPSUM HAVE EXTRA VALUES

You miss a good sales point if you don't tell dealers and farmers about the extra plant foods you give away in mixed fertilizers made with superphosphate. For every unit of phosphorus in superphosphate, you give the farmer about 137 pounds of gypsum (calcium sulphate). Both the calcium and the sulphur in gypsum are valuable plant foods. In addition, gypsum is an excellent soil conditioner.

By law, a complete fertilizer contains available nitrogen, phosphorus and potash. But most crops also need large amounts of three other plant foods: sulphur, calcium and magnesium. For many crops, sulphur is as important as phosphorus. Since sulphur leaches out of the soil readily, while phosphorus does not, sulphur must be added frequently. Fertilizers containing superphosphate are an excellent source of both. The highly concentrated, mixed fertilizers made with other sources of phosphorus lack the sulphur needed by crops.

Sulphur Leaches Fast

Legumes and some other crops use more sulphur than phosphorus. Small grains contain much phosphorus, while grain straw contains much sulphur. Both timothy and alfalfa hay contain more sulphur than phosphorus. Virgin soils are no better supplied with sulphur than with phosphorus. Experiment Station lysimeter tests show that the phosphorus loss in drainage water is too small to measure, but sulphur is lost at the rate of 30 to 60 pounds per acre.

Rainwater returns some sulphur to the soil, in areas where much coal is burned. But elsewhere, many soils are fast running out of sulphur. This makes your mixed fertilizers made with superphosphate an especially good buy. For the sulphur and the calcium contained in the superphosphate, farmers pay nothing but freight and handling costs.

Cotton is a heavy user of sulphur. So are corn, legumes, onions and cabbage. Some crops need more sulphur than phosphorus. Many soils are running out of sulphur fast. Gypsum in superphosphate helps put it back.

Strong Selling Points

This makes superphosphate the best phosphorus carrier to use on sulphur-deficient soils. On non-acid soils in general, the U.S.D.A. rates phosphate sources in this order: ordinary superphosphate, double superphosphate, ammonium phosphate, liquid phosphoric acid, calcium metaphosphate, di-calcium phosphate, tri-calcium fused phosphate, colloidal and rock phosphate. Yes indeed, your mixed fertilizers made with normal superphosphate have some strong selling points!

The gypsum in superphosphate is also an excellent soil conditioner. In fact, farmers use more than 740,000 tons of gypsum a year in addition to the gypsum they get in superphosphate. In a year's time, the gypsum in superphosphate used by farmers amounts to 4½ million tons—all for the cost of shipping!

When you ammoniate superphosphate for your mixed fertilizers, you are giving farmers a bargain in free sulphur, calcium and soil conditioner. You and your dealer will benefit by telling farmers about these bonus values.

Enduring Nitrogen Expands Non-Farm Fertilizer Market

Farm use of fertilizer has hit a temporary plateau but non-farm markets are growing fast. Twenty-two million non-farm home gardeners use more fertilizer per acre than farmers and pay a higher price. Highways, golf courses, playgrounds, cemeteries and nurseries are also big users of fertilizers.

These consumers prefer one-application, labor-saving fertilizers. That's why the new mixtures containing enduring nitrogen are proving very attractive. It will pay you to take advantage of this new interest in fertilizers to increase your sales and your profits.

Get All the Facts

Start now to investigate the use of urea-form nitrogen in mixed goods. You'll discover that there are several ways to use urea-form nitrogen to make long-lasting, high-nitrogen fertilizers that can be spread in one heavy application without danger of burning.

The best method is to use N-dure* urea-formaldehyde Solution, plus some solid Urea 45, in making mixed goods by your regular ammoniation procedure. This combination gives you everything your customer wants, in well-conditioned fertilizer, at low cost to you.

More Profit for You

By using N-dure Solution and Urea 45, plus other nitrogen sources, you can make a variety of ratios of enduring and quick-acting nitrogen. Using your present equipment, you can produce analyses of the major plant foods to fit every specialty market.

By proper formulation, you get dust-free, chemically-blended, semi-granular, top-condition, complete fertilizer with long-lasting, non-burning nitrogen, at a cost that gives you more profit.

For full information on the use of N-dure Solution, contact Nitrogen Division, Allied Chemical & Dye Corporation, 40 Rector Street, New York 6, N. Y.

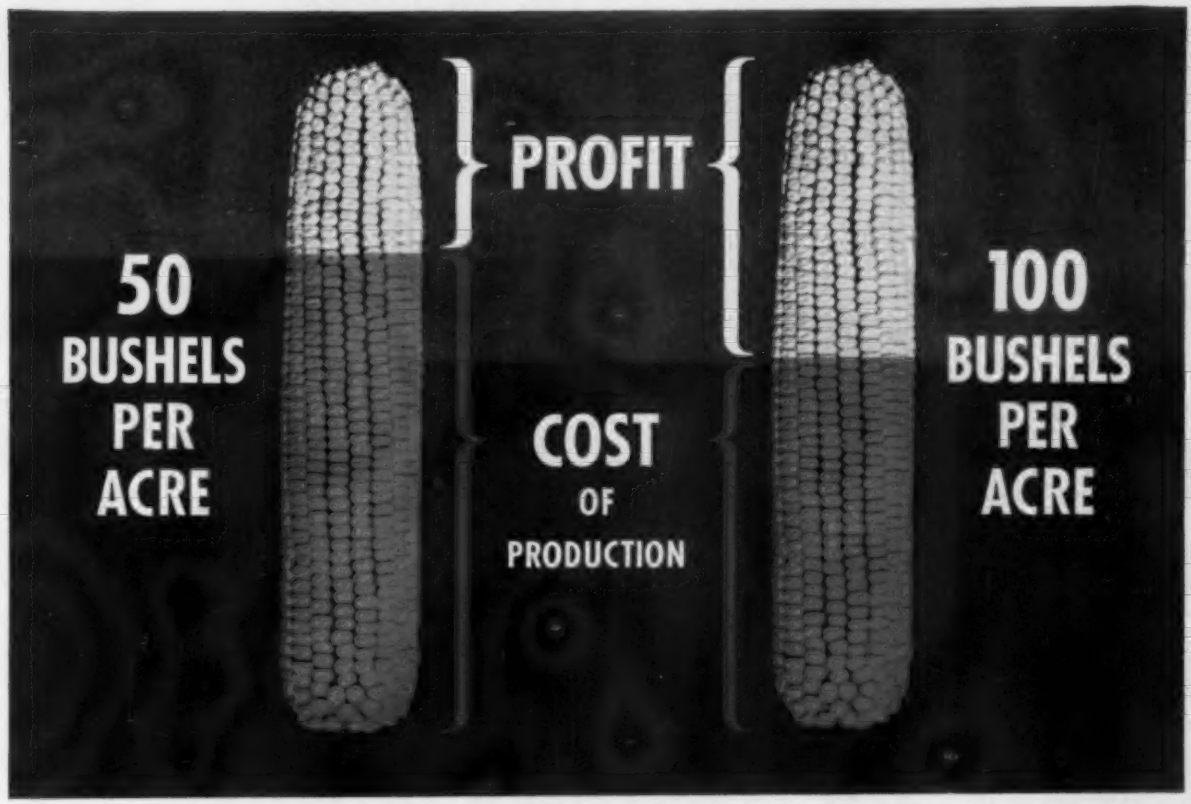
*Trade-mark

ANOTHER NITROGEN DIVISION AD to help you SELL FERTILIZER

Fertilizer Grows Farm Profits is the theme of the big, powerful advertising campaign now being conducted by Nitrogen Division, Allied Chemical & Dye Corporation, to help you and other fertilizer manufacturers sell a bigger tonnage of complete fertilizers to farmers.

The advertisement on the opposite page is the tenth in a series of full-page advertisements which have appeared in farm magazines reaching and influencing millions of farmers. This campaign is designed to tell the farmer that fertilizer is a profitable investment and the best help he can get under present conditions.

We trust you are pleased with this effort on the part of Nitrogen Division in behalf of the entire fertilizer industry. We will greatly appreciate any comments and suggestions you may wish to send to Nitrogen Division, Allied Chemical & Dye Corporation, 40 Rector Street, New York 6, New York.



How much of your corn is profit?

Part of every bushel of corn you grow is cost of production and the rest is profit. When you greatly increase your per-acre yield with fertilizer, you reduce your cost of production per bushel and increase your profit.

Fertilizer is low in cost. The extra yield added by fertilizer is the most economical and most profitable share of your crop.

The ears illustrated above show how fertilizer increased profits for typical corn growers on good land. Fixed expenses, such as land-use, management, labor and machinery were the same whether the yield was 50 bushels or 100 bushels per acre.

To increase the yield to 100 bushels, the only extra investment required was MORE FERTILIZER per acre, more seed for closer spacing and extra labor for harvesting the larger yield. Fertilizer added 50 extra bushels per acre at very low extra cost and far greater profit per bushel.

More fertilizer per acre is your best-paying investment. Results vary on different crops and soils but the basic economic fact prevails—a bushel or a pound of any crop can be produced much more economically when the yield is high than when the yield is low. More fertilizer is the direct route to high yields.

The price of fertilizer has not gone up like the price of most things you buy. It will pay you to use more fertilizer per acre! Right now is a good time to talk it over with your county agent and your fertilizer dealer!

***The fertilizer industry** serves the farmer. Nitrogen Division serves the fertilizer industry as America's leading supplier of nitrogen, the growth element in mixed fertilizers. Nitrogen Division, Allied Chemical & Dye Corporation, New York 6, N. Y.*

NITROGEN DIVISION ALLIED CHEMICAL

Fertilizer GROWS Farm Profits

HEADQUARTERS for NITROGEN

When you buy from Nitrogen Division, Allied Chemical & Dye Corporation, you are served by America's leading producer of the most complete line of nitrogen products. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions for the fertilizer industry. You are assured of dependable supplies from three huge plants at Hopewell, Ironton, and Omaha. Your nitrogen is delivered to you by the best transportation facilities and equipment. You get technical assistance and formulation advice from the largest and most efficient staff of nitrogen experts. Your sales are supported by the most powerful advertising campaign ever conducted to sell fertilizers. Nitrogen Division is your headquarters for NITROGEN *plus* SERVICE. Look over the big line and contact one of the 14 offices listed below.

Arcadian® Nitrogen Solutions

	CHEMICAL COMPOSITION %					PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®								
2	41.0	22.2	65.0	—	12.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	1.147	18	26
3	41.0	26.3	55.5	—	18.2	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	1.188	1	56
4M	41.0	19.0	72.5	—	8.5	1.194	7	61
6	49.0	34.0	60.0	—	6.0	1.052	48	-52
7	45.0	25.3	69.2	—	5.5	1.134	22	1
URANA®								
10	44.4	24.5	56.0	10.0	9.5	1.108	22	-15
11	41.0	19.0	58.0	11.0	12.0	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	1.081	25	- 7
13	49.0	33.0	45.1	13.0	8.9	1.033	51	-17
15	44.0	28.0	40.0	15.0	17.0	1.052	29	1
U-A-S								
A	45.4	36.8	—	32.5	30.7	0.925	57	16
B	45.3	30.6	—	43.1	26.3	0.972	48	46
[illegible]	82.2	99.9	—	—	—	0.618	211	—

Other ARCADIAN® Nitrogen Products: UREA 45 • A-N-L® Nitrogen Fertilizer
Ammonium Nitrate • American Nitrate of Soda • Sulphate of Ammonia

NITROGEN DIVISION Allied Chemical & Dye Corporation

MAIN OFFICE: 40 Rector Street, New York 6, N. Y., Phone: Hanover 2-7300

Branch Offices	Phone
Hopewell, Va., P. O. Drawer 131	Cedar 9-6301
Ironton, Ohio, P. O. Box 98	Ironton 8-4366
Omaha 7, Neb., P. O. Box 166	Bellevue 1464
Raleigh, N. C., 606 Capital Club Bldg.	Temple 3-2801
Columbia 1, S. C., 1203 Gervais St.	Columbia 3-6676
Atlanta 3, Ga., 127 Peachtree St., N. E.	Jackson 2-7805
Memphis 9, Tenn., 1929 B South 3rd St.	Whitehall 8-2692
Columbia, Mo., P. O. Box 188	Gibson 2-4040
Indianapolis 20, Ind., 6060 College Ave.	Clifford 5-5443
Kalamazoo, Mich., P. O. Box 869	Kalamazoo 5-8676
St. Paul 4, Minn., 45 N. Snelling Ave.	Midway 5-2864
Los Angeles 5, Cal., 2999 West 6th St.	Dunkirk 8-2301
San Francisco 4, Cal., 235 Montgomery St.	Yukon 2-6840

TECHNICAL SECTION

Small Fruit Pest Control

Controlling insect pests of small fruit is the subject of extension booklet 450, revised, published by the extension service of the State College of Washington, Pullman, Wash. Prepared with illustrations of the various pests which attack small fruits, the booklet lists control measures for each pest.

Also included are pictures of plants infected by the various insects to aid in the identification of injuries and the pests which cause them.

•

Cattle Grub Control Nears

The search for a chemical that can be given to cattle orally or by spraying to destroy cattle grubs inside the animal's body has turned up two insecticides that may be just what the scientists and livestockmen have been looking for, according to a report from the U. S. Department of Agriculture.

Most promising of these finds is Dow ET-57, a phosphate compound given to cattle by mouth as a drench or in a large pill. The other systemic is Bayer 21/199 which is administered by spraying over the animal. Neither chemical is available commercially as yet.

•

Sugar Beet Maggot Control

Experimental results in 1955 indicated that aldrin, dieldrin, and heptachlor at one pound per acre mixed with fertilizer effectively controlled the sugar beet root maggot. At that time insecticides mixed with fertilizer and applied directly in the row with beet seeds reduced germination and emergence.

Tests conducted in 1956 by the North Dakota Agricultural Experiment Station seemed to indicate that the solvent and carrier could contribute to the phytoxicity and confirmed the 1955 findings that the use of insecticide-fertilizer mixtures where maggots are a problem yields a high return. For example, if sugar beets brought $13.50 per ton, an increased income ranging from $40 to $60 per acre can be expected with an expenditure of approximately $3 per acre. Care must be used, however, as too large amounts of insecticides will seriously affect sugar beets.

Bimonthly Bulletin, Volume XIX, No. 3, Jan.-Feb., 1957, N.D. Agricultural Experiment Station.

•

TVA Granulation Process

TVA has under development a new one-step process for making granular triple-superphosphate. TVA reports the granular product is made in the TVA-developed ammoniator-granulator pilot plant which acts in this case as an acidulating drum.

Generally in the industry, granular superphosphate is made by producing non-granular material, allowing it to cure for several weeks, and then granulating it. This method involves additional cost, however, because it requires extra handling of the material and involves a drying step.

TVA investigators found in pilot-plant work that when phosphate rock and phosphoric acid—raw materials for triple superphosphate—are mixed in a rotating drum, the rolling action of the drum forms the material into pellets or granules. The product is dry enough to go directly to storage, where it remains for about a week to allow completion of the reactions.

Mites Resist Insecticides

Two species of redspider mites can survive repeated doses of organic phosphorous insecticides, according to Dr. Harold T. Reynolds and Dr. Lloyd Andres, entomologists at the Citrus Experiment Station, Riverside, Cal.

"Potentially, this is a serious situation," Dr. Reynolds said. "Growers have relied almost entirely on organic phosphorous compounds for mite control in cotton. Now it looks as though even this group of related compounds may lose much of its effectiveness against some of our important kinds of mites."

If the organic phosphorous insecticides become ineffective on a wide scale, non-systemic miticides can be substituted, Dr. Reynolds stated. Growers will have to take extra pains, however, to obtain excellent coverage in spraying or dusting, he warned.

•

Fruit Tree Pest Handbook

To meet the needs of New York state nurserymen in combating fruit tree pests, Dr. F. L. Gambrell, station entomologist, and Dr. R. M. Gilmer, plant pathologist, of the New York State Agricultural Experiment Station, Cornell Univ., have pooled information on pest control gained over the past six years in what is virtually a handbook for nurserymen. A copy of their publication is available upon request to the experiment station.

Virus and virus-like diseases of stone and pome fruits receive considerable attention. Major insect and disease pests of apple, cherry, peach, pear, plum, and quince nursery stocks are described and many of them illustrated.

CHARACTERISTICS OF NITROGEN MATERIALS

by J. Sharp

Spencer Chemical Co.

IMPORTANT characteristics of nitrogen materials, insofar as ammoniation and granulation are concerned, are shown in Table I and Figure I. They are listed as a convenient reference.

The examination of plant scale operating data, covering a wide variety of fertilizer grades indicated the granulation of mixed fertilizers, for most grades, was obtained at a range of from 33 to 35 per cent liquid phase. This concludes that our ability to determine liquid phase, based on the ideal solubility of the salts present, is sufficiently accurate to develop a theoretical method of study. For the purpose of this discussion, we define liquid phase as "The sum of the per cent salts in solution in the mix plus the per cent water at a given temperature, based on the ideal solubilities of each individual salt at that temperature." A figure thusly determined is not the accurate solution phase at all, but it does give us a tool with which to work and a means of calculating, or perhaps estimating conditions to shoot at in the ammoniator.

The relationships between raw materials, autogenous temperature, and required temperature for a 33 to 35 per cent liquid phase, graphically represented, allow determination of temperature-moisture requirements, in the TVA ammoniator, to produce the desired liquid phase.

Since recycle of fines is the commercial practice to granulate undersize particles and control the temperature and moisture, a step-wise procedure has been developed in order to calculate the recycle rate necessary to granulate a particular blend.

By plotting temperature vs. recycle, based on 12-12-12 operating data, the 35 per cent liquid phase falls along the top solid line and the 33 per cent liquid phase falls along the lower solid line. The actual operating point fell between the two solid lines at a temperature of 175° degrees Fahrenheit and a recycle rate of 2.5 to 1. Since the dryer temperature must be controlled to prevent the mix from becoming too hot and increasing the liquid phase in the dryer, reducing the moisture content to the proper level in the finished product has been a problem. To create more favorable drying conditions, a lower moisture content recycle was assumed. The dotted lines indicate the shift in 35 and 33 per cent liquid phase, based on a 1 per cent moisture recycle, as opposed to 2 per cent for the solid lines. The estimated operating point is at 215° degrees Fahrenheit, an increase of 40° degrees, whereas the recycle rate remains almost constant. This allows a 40° increase in dryer temperature also.

The obvious question then, is how can the moisture be lowered in the ammoniator so that higher temperatures may be employed. There are two ways that we know of and have used to some extent. One is to lower the moisture content in the raw materials. The other is to use a dryer recycle.

In commercial plant tests, it has been possible to reduce recycle about 50 per cent and to raise the ammoniator temperature about 25 degrees by using Spensol C-7 in place of Spensol C, or Spensol A-6 in place of Spensol A. Spensol C contains 16.6 per cent water, whereas Spensol C-7 contains only 7 per cent water. The ratio of free ammonia to ammonium

(*Continued on Page* 104)

TABLE I
Comparative Tendency of Important Fertilizer Materials to Absorb Moisture*

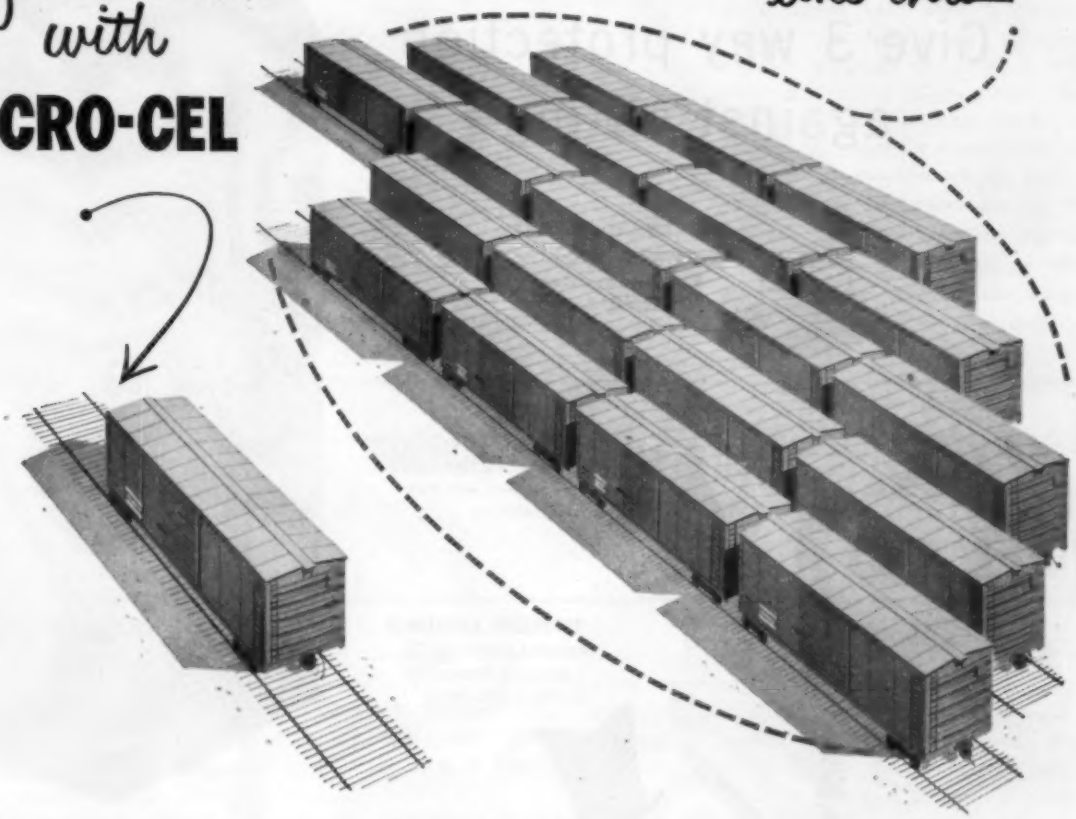
Material	Relative Humidity of air at 86°F (30°C) Above which material absorbs moisture (Critical Rel. Humidity)
Urea and ammonium nitrate	18.1
Ammonium nitrate and straight mono-calcium phosphate	38.6
Urea and nitrate of soda	45.6
Calcium nitrate, alone	46.7
Urea and common salt (as found in manure salts)	52.8
Urea and sulfate of ammonia	56.4
Ammonium nitrate, alone	59.4
Urea and muriate of potash	60.3
Ammonium nitrate and sulfate of ammonia	62.3
Urea and straight mono-calcium phosphate	65.1
Ammonium nitrate and muriate of potash	66.9
Nitrate of soda and common salt (as found in manure salts)	67.6
Manure salts, alone	72.2
Nitrate of soda, alone	72.4
Urea, alone	72.5
Sulfate of ammonia, alone	79.2
Muriate of potash, alone	84.0
Ammonium phosphate, alone	91.6
Mono-calcium phosphate (the pure compound, entirely free of acid)	93.7
Di-calcium phosphate, gypsum, limestone, sand and other insoluble materials	100.0

*"*Manual on Fertilizer Manufacture*, Second Edition, 1954, page 116, Vincent Sauchelli, Davison Chemical Company.

this shipment of 50% Heptachlor concentrate formulated with

MICRO-CEL

—can provide application quantities like this—



The advantages of formulating insecticide dusts at the higher concentrations obtainable with Micro-Cel* is graphically demonstrated by the freight cars above. One car of 50% Heptachlor when let down to a 2½% poison at the point of application produces the equivalent of 20 cars of insecticide in the field. Since Micro-Cel costs no more than many other diluents, the substantial freight savings mean extra profits for you.

PROVEN WITH MANY POISONS

Micro-Cel, a new line of synthetic calcium silicates developed by Johns-Manville, has been tested and proven at such high dust and wettable powder concentrates as:

75% DDT	**70% Toxaphene**
75% Aldrin	**75% Dieldrin**
50% Aramite	**50% Chlordane**

Experiments with other poisons are under way today.

IMPROVES FLOWABILITY

Micro-Cel—"the powder that flows like a liquid"—reduces caking, increases flowability and gives more uniform coverage with dry dusts. Other important properties include large surface area, small particle size and high balking action.

Ask your Celite engineer to help you adapt Micro-Cel to your particular requirements, or mail coupon below.

*Micro-Cel® is Johns-Manville's new absorbent-grinding aid designed specifically for the insecticide formulator.

Johns-Manville

MICRO-CEL

SYNTHETIC CALCIUM SILICATES

A PRODUCT OF THE CELITE DIVISION

Johns Manville, Box 14, New York 16, N.Y.
In Canada: Port Credit, Ontario
Please send ☐ further information; ☐ samples of Micro-Cel. I am interested in using Micro-Cel with the following poisons:

_____

☐ Please have your local representative contact me.

Name_____ Position_____

Company_____

Address_____

City_____ Zone_____ State_____

CONTINENTAL'S

DUOTITE BAGS

Give 3 way protection against sifting

DOUBLE-FOLD HEAT SEAL
Easy, safe closure for filled bags

DUOTITE BOTTOM
Double folded heat seal absolutely will not permit sifting

INNER LINING
Natural kraft or special lining for extra protection

You assure your customers of full measure and safe delivery of dry chemicals — even sift-prone and poisonous powders — when you pack them in Duotite bags.

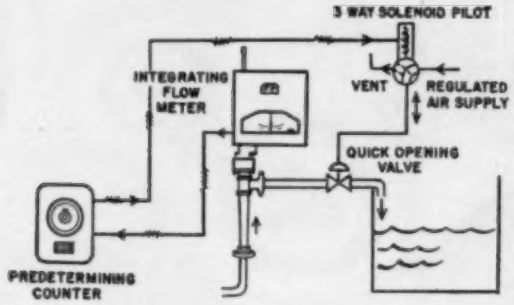
Duotite bags are made with strong Kraft outer wrappers and lined with a wide selection of papers and films to suit your product. They are designed to enable you to make sift-proof closures — heat sealed if preferred. Bottoms are double folded — heat sealed and pasted to give positive protection against sifting.

Continental makes a complete line of packages for special chemical products. Call on us for the answer to your specific packaging problem.

CONTINENTAL CAN COMPANY

SHELLMAR-BETNER DIVISION

QUALITY PRINTERS AND CONVERTERS OF FLEXIBLE PACKAGING MATERIALS



The single component batch control system measures the flow rate and volume of fluid passing through.

PROPORTIONING FERTILIZER INGREDIENTS

by Donald J. Tricebock
Fischer & Porter Co.

THE combination of a dust problem, continuous handling and mixing of highly corrosive chemicals, and the need to produce a satisfactory dry product create a not too simple materials handling problem for the fertilizer manufacturer. Ultimate customers do not often go to the trouble of making a chemical analysis of products, but from a quality viewpoint as well as that of the regulatory bodies in the fertilizer industry, it is essential that manufacturers produce a product that meets high quality standards. To do this, it is essential that each and every one of the ingredients involved in the production of fertilizer be properly measured, controlled, and proportioned one to the other. There are numerous ways of doing just these things, some of which are discussed below.

In a very simple form of continuous flow control, is a device which senses the actual flow rate of fluid in a pipe line. Having sensed this flow rate it becomes necessary to convert the value determined into some other useful measuring means.

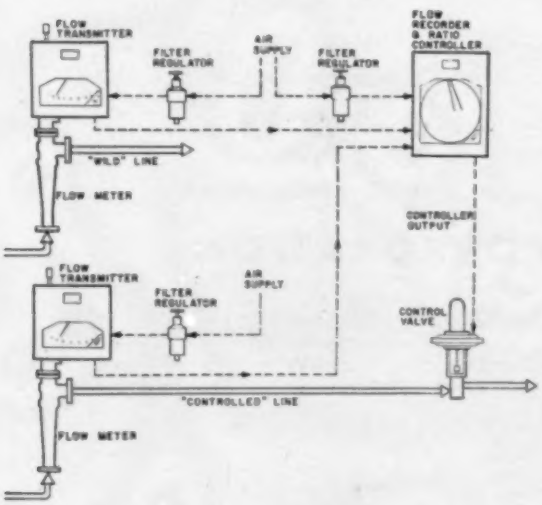
In most cases simply holding a single stream to a constant value is not nearly enough control. It is necessary that several different materials be mixed in certain proportions one to the other. One method of doing this is by batch control. This system measures the rate of flow of fluid passing through it at any time and computes the total volume of fluid by means of a flow integrator, which is built right into the instrument. This integrator, besides keeping account of how much fluid has passed through the flow meter, also provides an electrical signal each time a certain amount passes through. For example, the flow integrator can be set to provide one electrical pulse for every ten gallons of liquid, or it can be set to provide one pulse for every gallon of liquid that passes through the meter. In any event, these pulses are sent to a device known as a predetermining counter. This counter accepts the electrical pulses and in turn keeps track of the number it has received.

Before starting the system it is necessary that the operator first determine how many gallons of this particular liquid are to be used in the batch. Having determined the number of gallons—or pounds or what-

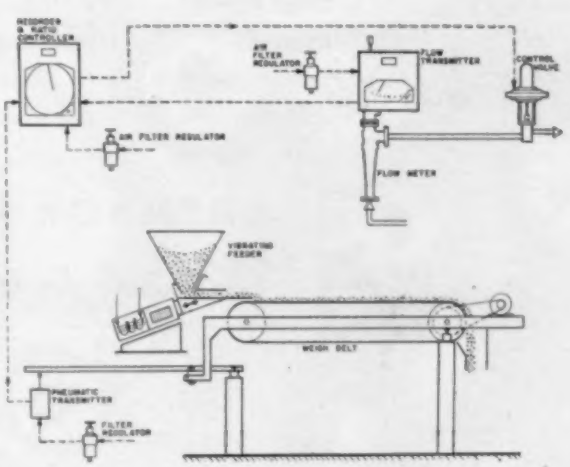
(Continued on Page 103)

*Presented at the Fertilizer Industry Round Table, October 16, 1956, Washington, D. C.

The continuous ratio control system for two fluid streams, one of which is controlled so that its flow rate remains a fixed ratio of the other.



The ratio control system used on dry feed lines works with the same principles as the fluid stream system. The conveyor belt measures the dry material as it passes over.



SYSTOX*

Registration Status

Introduced in 1951, SYSTOX has given consistent and outstandingly effective control of mites, aphids and leafhoppers on a wide variety of crops. The first systemic insecticide ever approved for use on a food crop, SYSTOX registrations now include:

Cotton	Cauliflower	Muskmelons
Oranges	Potatoes	Pineapple
Grapefruit	Lettuce	Walnuts
Lemons	Cabbage	Pecans
Seed Alfalfa	Apples	Almonds
Beans	Pears	Ornamentals
Brussels Sprouts	Grapes	Non-Bearing Fruits
Broccoli	Strawberries	

*Registered Trademark

CHEMAGRO CORPORATION

"Chemicals for Agriculture—Exclusively!"

437 FIFTH AVENUE NEW YORK 16, N. Y.

WASHINGTON REPORT

By Donald Lerch

WASHINGTON'S famed farm block is turning much of its strength to "infighting" rather than presenting a united front on some of the major farm issues facing the nation. Debate on corn legislation and several other key items has touched off some of the most acrimonious debate Washington reporters have heard in several decades. Some observers think the wounds are going to stay open a long time.

Fundamentally farm lawmakers know that farmers are in trouble and that there's no immediate easy way out. In fact, some believe that the farm problem is going to become more critical before it gets better. Even in this "non-political Washington year" the line-up on issues is becoming more and more along party lines. This is a switch from the traditional split of the farm block along commodity lines.

Fundamentally the Democrats want higher price supports, whereas most of the Republicans are still backing Secretary Benson in his lower, flexible supports. The Democrats probably could push their measures through the Congress, but then they'd run smack into a Presidential veto, as was the case last last year. Farm reports reaching Washington from over the country show that many farmers are confused and irritated over provisions of the Soil Bank. The feeling here in many quarters is that the best part of the Soil Bank is the pleasant sound of the two words themselves. The sign-up to reduce production of key crops is falling far short of the goal. Regardless of the corn program, more corn will be planted than the Administration would prefer. The same applies to cotton. While wheat acreage is cut, much of that same land will go into feed grains, adding to the Administration's fear that this may touch off a big up-swing in cattle, hog, and milk production.

When spring comes, the farmers want to plant, and Washington's attempt to hold them back isn't making much of a hit. The more Washington squeezes the agricultural production balloon in one area—the more it bulges in another.

This is why private forecasters believe record amounts of fertilizer will be used this year. They feel that despite the government's acreage reduction programs, farmers will plant huge acreages of all crops and will pour on the fertilizer. Fertilizer's favorable position on the rising price escalator is being recognized by more and more farmers, reports show. The fertilizer industry's basic educational program and individual campaigns by companies look as though they may well turn the tide of fertilizer consumption and put 1957 into the increase column.

* * * * *

Significance of the realignment in the U.S. Department of Agriculture's Agricultural Research Service falls in two main categories.

First, the former Entomology Branch headed by Dr. E. F. Knipling is now a division, and entomologists are grouped together more than previously.

Secondly, scientists everywhere will applaud the shift from the term Branch to the term Division in the whole organization of the Agricultural Research Service, for this paves the way for higher salaries for scientists.

Immediate reason for these changes, however, is quite different from the two above points. Intense Congressional interest in utilization research triggered the shift leading to the alignment of research on new uses for agricultural products to be administered separately under a deputy administrator for utilization research and development. The new deputy administrator in this post is George W. Irving, Jr., until now the Service's Deputy Administrator for Research. The appointed Deputy Administrator for Production Research is Theodore C. Byerly, who has been Assistant Director for Livestock Research.

Formerly there were nine branches in the production research phase of the Agricultural Research Service. They have now been changed to seven divisions. Two of the crop branches and two of the livestock branches have been lumped together to bring about the reduction.

In most cases you'll still see the same folks when you visit Beltsville, but the chances are their titles will be slightly different.

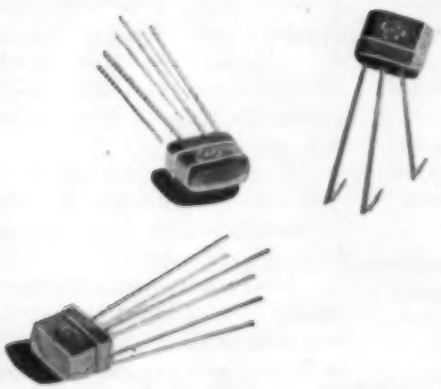
Many scientists share Dr. Byron Shaw's opinion that administrative responsibility should not necessarily be a criterion in pay scales for scientific work. Dr. Shaw is Administrator of the Agricultural Research Service. In many cases, a scientist spending all of his time in scientific work can be worth as much or more money than a man in an administrative capacity handling the finances and related aspects of a division's

(*Continued on Page* 117)

Sulphur

helps to create
Headline Products

GERMANIUM



Not too long ago this relatively rare metal was a laboratory curiosity. What to do with it? Today, it's the heart of the tiny transistor—the latest giant of electronics!

What's the connection between Sulphur and Germanium?

There are two, in fact. One is man-made, involving the routine leaching of Germanium ores with Sulphuric Acid prior to tetrachloride distillation. The other takes advantage of a peculiar property of the natural mineral, Germanium Sulphide. This mineral can be volatilized and then sublimed, providing an effective method of separating the Germanium from gangue material. The process is called "Concentration of Germanium by Sulphide Sublimation".

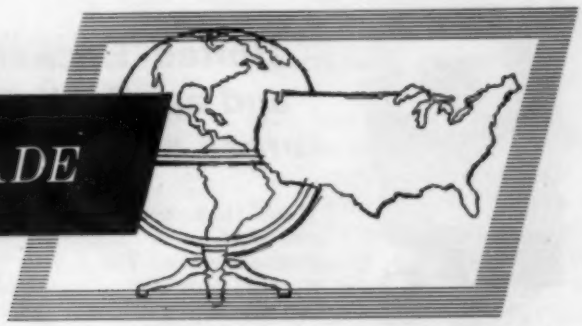
Again Sulphur, through its major derivative, Sulphuric Acid, and a natural sulphide play an important role in our ever-expanding economy. It is difficult to find many items in the broad chemical-metallurgical field that do not somewhere along the production line make use of Sulphur or a derivative.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units
- Newgulf, Texas
- Moss Bluff, Texas
- Spindletop, Texas
- Worland, Wyoming

NEWS about the TRADE



J. Merritt Joins Merck

James M. Merritt, has been named manager of plant chemical development for Merck & Co., Rahway, N.J. He was formerly manager of commercial products of Diamond Black Leaf Co.

The Merck division is a new group being established in the product development department to coordinate development of "Gibrel" and other plant chemicals that Merck originates. Plans for the department call for staffing with specialists currently located in the major agricultural areas of the country as well as at Rahway, N. J., where laboratory, greenhouse and formulation work can be concentrated. Mr. Merritt will be assisted by C. M. Gates, who will be active in the western states.

•

UCCC to Drop "& Carbide"

The Union Carbide & Carbon Corp., New York, proposes to change its name to Union Carbide Corp. If shareholders approve at the annual meeting April 16, the change will be made on May 1.

•

Butcher Plant Completed

The L. H. Butcher Co. announce the completion of construction and installation of an insecticide dust plant at Portland, Oregon, for production of Butcher Brand products. Lee R. Hansen is manager of the agricultural chemical department for the Pacific Northwest, Oregon, Washington and Idaho. His assistants are W. B. Radey, Portland, and Hewitt R. Harrison, Seattle.

The L. H. Butcher Company have major offices and warehouses in Los Angeles, San Francisco, Fresno, Portland, Seattle and Salt Lake City. They have insecticide plants at Los Angeles, Fresno and Portland. In addition to formulation of insecticides and agricultural chemicals, the L. H. Butcher Company are manufacturers and agents in the distribution of industrial chemicals, agricultural chemicals, etc.

Mr. Roy Hillebert is manager of agricultural chemical department for the Pacific Southwest, California, Arizona and Nevada. P. Farris was recently appointed manager of the Fresno, California, agricultural chemical plant, and Allen Hale as assistant manager.

•

Gibberellins on Home Market

A number of products for the home gardener containing gibberellic acid are already on the home garden market. Among products now available are "Plant Shoot," offered by Nott Manufacturing Co.; "Spurt," by Doggett & Pfeil; "Mira-Cell" by Stern Co.; and "Tri-O-Gen Gibrelin" by Rose Manufacturing Co.

The basic producers and suppliers of gibberellic acid are: Merck & Co., Rahway, N. J.; S. B. Penick & Co., New York; Abbott Laboratories, Chicago; Chas. Pfizer Co., Brooklyn; and Eli Lilly Co., Indianapolis.

•

Mrs. W. W. Allen Dies

Mrs. W. W. (Elsa) Allen, passed away Friday, March 8th, at Ford Hospital, Detroit. Her death, which was unexpected, was due to acute heart failure.

A native of Cleveland, Mrs. Allen lived in Midland, Mich., for 23 years. She married W. W. Allen in 1936. Mr. Allen is manager of agricultural chemical sales for Dow Chemical Co.

Mrs. Allen was a familiar figure at NAC meetings. She is survived by her husband, a son, James, and a daughter, Gail Elsa.

•

Fertilizer Round Table Dates

The 1957 meeting of the Fertilizer Industry Round Table will be held in two sections: The group discussions concerning analytical techniques will be held October 17th at the Shoreham Hotel, to coincide with meeting of the Chemical Control Committee of NPFI, and the Fertilizer Control Officials. Discussion on production control problems will be held at a meeting Nov. 6-8 at the Sheraton Park Hotel, Washington, D. C. Program details for both sections will be announced next month.

•

Fluid Energy Appoints McKenna

Fluid Energy Processing & Equipment Co., Philadelphia, recently retained Joseph P. McKenna as director of technical service and sales, with particular emphasis on the agricultural chemicals industry. The firm manufactures grinding mills among other equipment.

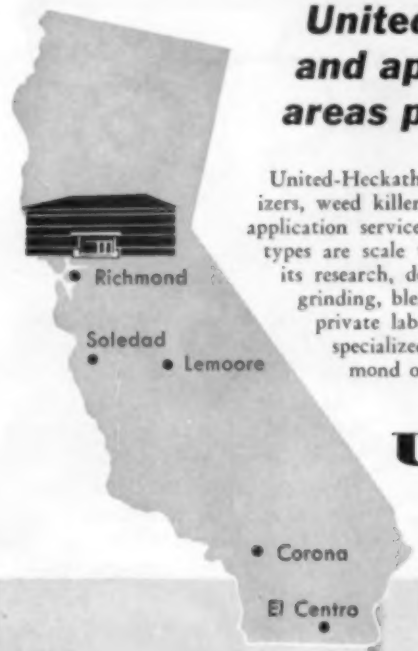
•

North Central ESA Meets

The twelfth annual conference of the North Central Branch of the Entomological Society of America was held March 27, 28, and 29 at the Hotel Savery in Des Moines, Iowa.

C. E. Mickel, chairman of the branch, presided at the meetings. Among the subjects discussed were: Insect Rearing and Testing, Truck Crop Insects, Survey Methods and Evaluation of Populations, and Insecticide Residue Problems.

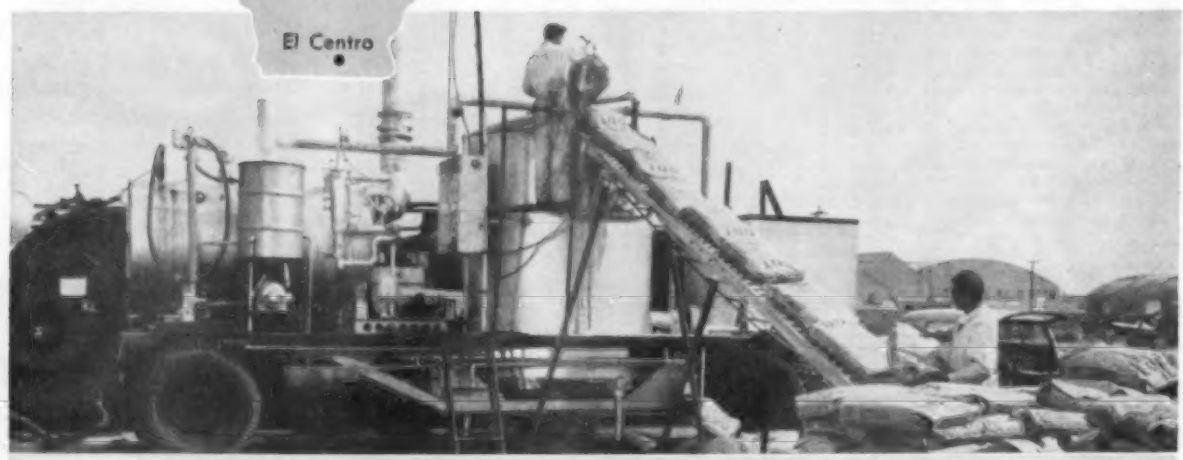
An opening day discussion on cereal crop insects, under the chairmanship of J. W. Apple, was divided into three parts. C. C. Burkhardt talked on corn earworm control in sorghum. A panel comprised of F. Strong, J. H. Lille, L. K. Cutkomp, J. H. Bigger, and R. A. Blanchard



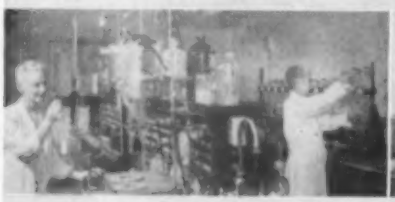
United-Heckathorn chemical manufacturing and application facilities in key agricultural areas provide first complete local service

United-Heckathorn permanent or portable plants manufacture insecticides, fertilizers, weed killers, fungicides and fumigants on location and offer aerial or ground application service. The portable plants may be transported to your job site. Both types are scale versions of United-Heckathorn main Richmond, Calif., plant with its research, development and control laboratories . . . vast facilities for mixing, grinding, blending of dry materials and liquids for bulk sales, custom processing, private label packaging . . . engineering for construction and maintenance of specialized processing and application equipment. United-Heckathorn, Richmond or any of the affiliated plants are at your service and invite your call.

UNITED Heckathorn



Portable plant compounding chemicals for aerial spraying of beet leaf hopper on 250,000 acres of Kettleman Hills, Calif.



Main Laboratory, Richmond. Chemists, machinists and other technical supervisory personnel accompany field jobs.

Extensive ground application work and chemical sales at Soledad, Calif. in the center of the "Salad Bowl" Salinas Valley.

Packaging and delivery for sales of agricultural chemicals for citrus crops, Corona, Calif.

Formulation and application, aerial and ground, in Imperial Valley, the world's largest vegetable growing center.

Formulation of dry & liquid insecticides for San Joaquin Valley, Lemoore plant near Fresno, center of cotton, potato & grape areas.

UNITED-HECKATHORN

Main office and plant: 600 S. Fourth Street, Richmond 4, Calif.

Phone: LAndscape 5-9210

Plants at Soledad, Corona, El Centro, Lemoore

discussed the protection of corn seed and seedings from soil insects, and control of the European corn borer was discussed with regard to both biological control and control with insecticides.

Control of forage crop insects was the subject of a session which contained talks by Richard Thurston. B. A. Haws, and R. W. Kieckhefer, among others. Instructions for killing "ten little pests," whose number included weevils, beetles, grasshoppers, and spittlebugs, were provided by a group of state research workers. R. H. Wilson, T. L. Harvey, and M. C. Wilson followed with methods of breeding for resistance.

A panel discussing the evaluation of grain fumigants was moderated by HH. H. Walkden and was comprised of Eugene E. Kenaga, J. Carl Dawson, and E. D. Wilber. Fred L. Watters told the conferees of the use of malathion as a grain protectant.

The physiology and toxicology session featured a panel whose subject was, "Are the problems of resistance to chlorinated hydrocarbons similar to those with organophosphates?" L. E. Chadwick moderated and C. W. Kearns and L. K. Cutkomp comprised the panel. S. D. Beck told of varietal resistance to the European corn borer and discussed corn plant growth characteristics and resistance to the corn borer.

The Insecticide Residue Problems session, which closed the conference, contained a talk on the federal laws and insecticide recommendations by Justus Ward. A panel discussed what the Miller Bill means for 1957 and Clifford C. Roan charted the future course of research on chemical residues on and in fruits and vegetables.

•

Cal. Fertilizer Conference

The fifth annual California Fertilizer Conference will be held at Fresno State College, Fresno, on April 15. The program will include technicians of the agricultural colleges and fertilizer industry in the state as well as autsorities from other areas. The meeting is sponsored by the Soil Improvement committee of the CFA.

Grand River Names Straub

Earl Straub has been named sales representative of the Grand River Chemical division of Deere & Co., Pryor, Okla., for Missouri and the surrounding area. Mr. Straub represents the company's full line of nitrogen products including VITREA, 45% nitrogen fertilizer, urea feed compound, nitrogen solutions, and anhydrous ammonia.

•

Aerial Operator Dies

While ferrying an empty Tri-Pacer, Lloyd W. Ford of Yuma, Colorado, was killed February 18. Mr. Ford was president of the Oasis Chemical Co., Imperial, Colo. He is survived by his wife and two daughters.

Mr. Ford attended Yuma High School and graduated from Colorado A & M. He came to the Imperial Valley in 1947 and started VisCo, with J. Veddar in 1950.

He was a member of the El Centro Elks, Alpha Zeta Honorary Fraternity, and the Entomological Society of America.

•

Canadian Entomology Conf.

The seventh annual meeting of the Entomological Society of Canada, and the fifth annual meeting of the Entomological Society of Alberta will be held jointly at Lethbridge, Alta., Canada, October 29-31.

•

Louisiana Reports on Sales

A recent report by the State of Louisiana on insecticide sales in 1956 showed a substantial increase in use of calcium arsenate and decrease in the chlorinated hydrocarbon insecticides.

Calcium arsenate sales were up to 9,007,819 pounds, compared with 1,840,598 in 1955. BHC-DDT-Sulfur dusts were down to $4,702,000 pounds compared with 14,130,500 pounds in 1955. Corresponding decreases in use were noted in sale of BHC-DDT dusts; heptachlor-DDT-sulfur dusts; dieldrin-DDT-sulfur, etc.

Approximately 27,000,000 pounds of dusts and 336,000 gallons of spray concenttrates were sold during the year,—a slight decrease from the quantities used in 1955, due primarily to the dry season in 1956.

•

O-M Net Sales Up in 1956

Consolidated net sales of Olin Mathieson Chemical Corporation in the United States and Canada increased by 6.5 per cent in 1956 to a record high of $596,673,005. Sales in 1955 totalled $560,480,335. Net income increased from $44,558,102 in 1955 to $44,791,071 in 1956.

The report noted that the company increased its net income in spite of reduced profits on agricultural chemicals caused by lower farm income and drought conditions; reduced sales of brass and brass products due principally to the high and fluctuating price of copper; and a prolonged strike, settled in January, at the sodium phosphates plant at Joliet, Ill.

•

Alfalfa Aphid Resistant

The spotted alfalfa aphid is reported to have developed resistance to widely used chemicals in California areas. The first signs of failure against this pest by two chemicals, parathion, and possibly malathion have been reported by entomologists at the University of California, Riverside.

The resistance problem is located primarily in the Mojave River basin and the Imperial Valley, with lesser amounts in Antelope and Coachella valleys.

To alleviate the situation, a number of new insecticides are being tested by university scientists.

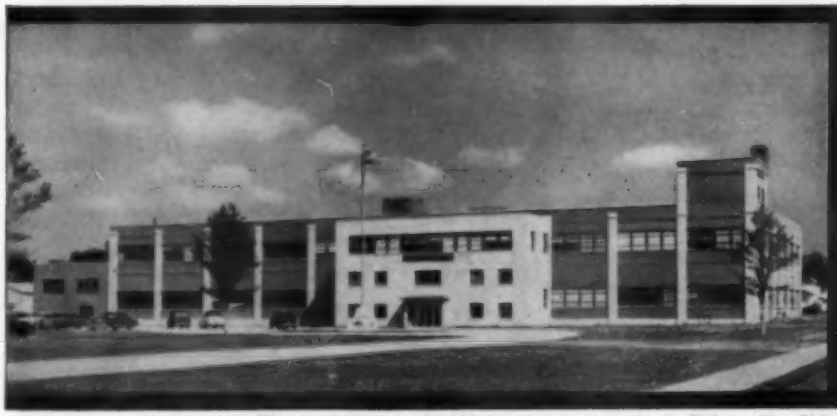
•

Panogen and Larvacide Join

A joint announcement by P. Hellman, president of Panogen, Inc., and C. C. Johnson, president of Larvacide Products, Inc., indicates that the two companies are joining forces as a result of the Panogen group acquiring the stock of Larvacide Products, Inc.

Larvacide Products will continue to operate as a separate company under management of C. C. Johnson. R. P. Porter remains with Larvacide as vice president in charge of sales. Larvacide will make its headquarters at Ringwood, Ill., instead of New York City.

DIAMOND insecticides and herbicides are known for dependable potency



We make sure of it here

Diamond's research and development center in Painesville, Ohio

So you can count on peak performance here

Write for literature on any of our products, and feel free to consult our technical staff when you have special problems. Your inquiries are welcome. DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS

Diamond Chemicals

DIAMOND AGRICULTURAL CHEMICALS

- DDT
- BHC
- LINDANE
- MITICIDE K-101 (Ovex)
- Seed Disinfectant
- 2,4-D Weed Killers
- 2,4,5-T Brush Killers
- Grain Fumigants
- Wettable powders, emulsifiable and oil solutions; and dust concentrates based on our technical grade chemicals

and many other chemicals that help farmers, gardeners, cattlemen and orchardists.

Shown at the Western Cotton Production Conference in Phoenix, Ariz., March 4-5 are, (left to right) J. Clyde Wilson of Buckeye, Ariz., a speaker on the program; Claude L. Welch, director of the production and marketing division of the National Cotton Council; Dr. Richard A. Harvill, University of Arizona president; and Cecil H. Collerette, Casa Grande, Ariz., cotton producer who was general chairman of the conference.

Resistance Studied on Cotton Conference

DELEGATES to the 1957 Western Cotton Production Conference, held at the Hotel Westward Ho in Phoenix, March 4 and 5, were told that resistance of cotton insects to insecticides is the number one problem facing cotton entomologists today. K. P. Ewing, who is in charge of the cotton insect section of the U. S. Department of Agriculture, Beltsville, Md., named the boll weevil, cotton leafworm, cabbage looper, saltmarsh caterpillar, onion thrips, and some species of spider mites as those insects which have developed resistance to certain of the organic insecticides.

Mr. Ewing also said that "present evidence points to the development of resistance in local areas by the cotton aphid, beet armyworm, southern garden leafhopper, cotton leaf perforator, and lygus bugs."

"As far as I know," Mr. Ewing continued, "there are no indications that the bollworm, a major pest in this area, has become resistant to insecticides in this country. There are, however, such reports from South America." Mr. Ewing concluded his address by pointing out that most of what has been done to combat the problem is of a stop-gap or short-range nature. He called for expanded research to discover the nature and causes of resistance and to work out a permanent solution to the resistance problem.

John J. O'Dell, local county agent from Pheonix, told the convention that cultural practices between harvest and planting time not only protect the young cotton plant from insect damage but also usually reduce the number of applications of insecticides required for control during the growing season. He also pointed out that with a smaller number of applications, there is less chance that pests will build up resistance to popular insecticides.

Practices cited by Mr. O'Dell included stalk destruction in the field and cleaning of ditch banks, field borders and waste areas. He said the growing of stub or volunteer cotton contributes to insect problems because the stalks and undisturbed soil furnish a place for the insects to live through the winter.

A nematologist from the Cotton Research Center, Tempe, Ariz., Dr. Harold W. Reynolds, disclosed that the average annual loss from seedling diseases of cotton during the past five years in the Southwest is estimated at more than 342,000 acres—almost as great as the total number of acres harvested in Arizona. He said that the most troublesome seedling disease is caused by the Rhizoctonia fungus.

Dr. J. N. Roney spoke on early season insect control and reported that a host of pests prey on cotton seedlings during the early part of the season and they must be controlled if a good stand is to be preserved.

General chairman of the conference was Cecil H. Collerette, cotton producer of Casa Grande, Ariz., and chairman of the Production and Marketing Committee, National Cotton Council.

•

Soil Bank Starting Strong

Soil bankers in Washington, D. C., have predicted that they will reach their minimum goal of retiring about 20 million acres from production this year, with a little to spare. This total would equal more than six per cent of the land on which major crops were harvested last year.

Soil bank operators are worrying, however, over lagging signups in such major crops as corn and tobacco. Also, there is evidence that the bank is being used partly as a drought relief mechanism or to idle land that wouldn't produce much anyway.

•

Aerial Applicator Survey

The Aerial Applicator division of the National Aviation Trades Association, Washington, D. C., has launched a nation-wide survey covering agricultural aviation activities. The questionnaire covers material which will supplement information of the Civil Aeronautics Administration.

In addition to general data on revenues, investments, type aircraft used, and work performed, the survey covers information on charges, personnel employed, and insurance coverages, together with information on the use of toxic chemicals and means of improving safety.

•

DuPont 1956 Business Dips

Sales, earnings, and dividends of the Du Pont Co., Wilmington, Del., in 1956 were the second highest in the company's history, exceeded only by the record highs established in 1955. Sales were $1,888 million, or one per cent lower than in 1955, while physical volume of sales was about three per cent higher.

As a result, net earnings from operation as a percentage of operating investment declined from 13.8 per cent in 1955 to 11.3 per cent.

No moly, no heads; cauliflower crop a total loss.

Can You Spot Crops Starved for Moly?

Recognizing moly-deficiency symptoms early enough to recommend moly applications can turn withering crops into healthy stands

At a technical meeting several years ago, someone asked a speaker where responses to molybdenum applications are most likely to be found. The speaker quickly answered, "On soils near an experiment station with a staff member who's familiar with moly-deficiency symptoms and who's testing for molybdenum responses."

This remark wasn't made entirely to provoke a laugh, notwithstanding the need for a little humor at technical confabs.

What the speaker was underscoring was that we didn't then have any idea how extensive the need for moly in the United States might be. There were relatively few agricultural people who knew much about moly, especially its effects in the field. Those few who did —naturally concentrated at places such as experiment stations—found soils that needed moly because they knew what they were looking for.

Dotting the Map

Now some years later, we have expanded our knowledge of moly's role in practical farming considerably. The once few pioneers working on moly at experiment stations are now many. They and other soil scientists at universities and research institutions, as well as farmers themselves, have dotted the map (see illustration) with locations of soils requiring moly for full productivity. At least thirty crops have been shown to respond to moly applications. Of these, ten are now being grown commercially in the United States with the aid of moly.

But, although we have come a long way with moly in just a few years, many growers are still getting marginal yields, or even losing crops, because they don't recognize the symptoms of moly starvation. They can see that something is wrong, but they don't know what. They either haven't heard, or can't believe, that as little as a few ounces to a pound of moly per acre can mean the difference between skimpy, curled, twisted and scorched plants of little value and healthy crops of prime quality.

Key to Growth

Moly, while required in amounts considered minute even for a trace element, performs two essential functions in plants. It is needed for the fixation of atmospheric nitrogen by the bacteria in the root nodules of legume crops. It also is required in all crops, non-legumes as well as legumes, in the reduction of nitrates to nitrogen—the first step in protein synthesis.

Plants lacking sufficient moly show characteristic symptoms related to moly's key role in plant growth. Legumes have the well-known signs of nitrogen starvation. They are stunted, pale yellowish in color, low in protein content and hard to establish; fields are patchy. Non-legumes exhibit yellowish coloration in the leaves—chiefly in spots where nitrate accumulates between the veins and around the rim—and often the leaves are curled or cupped upwards, or otherwise distorted. Growth is poor and irregular, and the crop has an overall pale yellowish cast.

Some of these symptoms had been recognized as specific diseases—e.g., "whiptail" of cauliflower and "yellow spot" of citrus—for years before moly deficiency was discovered as the cause.

Following are more detailed descriptions of easily detected symptoms in common crops:

Beets. Plants may be stunted. Leaves narrow. Yellowing leaves make red veins stand out.

Cauliflower, broccoli. Whiptail. (See illustration.) Heads do not develop, or develop unevenly.

Cabbage. Yellowish mottling throughout leaf area between the veins. Heading prevented by twisting and cupping.

Peas. Leaves turn yellow and become somewhat transluscent. Dwarfing occurs. Vines weak and short.

Beans. Yellowish mottling sometimes called "scald". Flower and seed yield often greatly reduced.

Tomatoes. Curling and cupping of leaves. Formation of flowers and fruit reduced.

Celery. Tops turn pale green, then yellow.

Cantaloupe, cucumbers. Leaves are light green to yellow, develop edges which wither and curl. Stunting.

Differences in Soils

Crop response to moly application is often observed on soils of low pH, since under acid conditions moly is often tied up in a form unavailable to the plant. Liming, in making the soil more alkaline, releases moly to plants, and on some soils, this release of acid-bound moly may be the chief function of lime. In such cases, a few ounces of moly may be more effective and economical than several tons of lime.

Soils likely to be extremely low in moly are those that have been highly leached, such as coastal sands and hill country soils, soils that have been heavily cropped, and soils in areas of heavy rainfall. Conversely, highly productive, fertile soils, heavily limed or manured soils, and soils in regions of low rainfall are unlikely to produce visible deficiency symptoms, but increased yield and better quality may result from moly application.

In the United States, most reported responses to corrective treatment with moly are in the areas east of the Great Plains, and along the Gulf of Mexico, and in the Pacific Northwest. But until more testing is done, it is unwise to say categorically that crops grown in other areas won't respond to moly.

No Trick to Testing

Deficiency symptoms and soil types are good guides to the possible need for moly but they aren't infallible diagnostic aids. Systematic testing should always precede general application to the field.

It's easy to do:

The first step is to make up a stock solution by dissolving one ounce of sodium molybdate in one gallon of water.

With vegetable crops such as cauliflower, broccoli and beets, select and mark one or more rows in the center of the field. Diluting three cups of stock solution to one gallon of water, apply the moly to the test rows, at the rate of one quart per 250 feet of row. Compare treated and untreated rows every other day.

With legumes such as alfalfa and clover, lay out a test plot 10 yards square adjacent to an untreated area to be used as a control. Follow your usual fertilizer program, but use no nitrogen on either control or test plot. Spray the test plot with one cup of stock moly solution diluted to one gallon. Applications can be made at seeding time or to an established stand. Make regular observations, comparing thickness of stand, color and quality of growth.

For a one-ounce test sample, and further information on how to lay out test plots, address Dept. 43, *Climax Molybdenum Company, 500 Fifth Avenue, New York 36, N. Y.*

USDA Completes Summary of Pesticidal Chemicals

THE USDA has recently completed compilation of a "Summary of Certain Pesticide Chemical Uses." The summary is a series of charts, now in the process of publication, which will be completed about the end of April. Copies of the manual will be sent to each registrant of an economic poison. It has been prepared as a looseleaf book to aid registrants of economic poisons under the provisions of the Federal Insecticide, Fungicide and Rodenticide Act, in proposing labeling which will be acceptable for registration when judged in relation to the Miller Pesticide Amendment. It is not intended to modify or supplant any recommendation made by the USDA or by the various States, although it may have an indirect influence on them.

In developing the charts which comprise the summary, consideration has been given only to those uses of pesticide chemicals on raw agricultural commodities which have been registered under the Act. (However, some of the charts include certain limitations which have not previously been registered.) The charts take into consideration all of the tolerances and exemptions which have been established under the provisions of the Federal Food, Drug, and Cosmetic Act, including those established under Public Law 518 prior to February 15, 1957. Tolerances, exemptions, and registered uses taking effect after February 15, 1957, will appear as revisions of the separate charts, to be issued as soon as possible after the basis for the changes required and the evidence supporting them have been submitted. The charts also include those pesticide chemicals which have been declared "safe" under Public Law 518 when they are used in accordance with good agricultural practice. In addition, they carry uses which are justified on the basis that there will be no residues on the food crop when the pesticide chemical is used as directed.

The summary includes only those applications of pesticides to raw agricultural commodities which information available to the Pesticide Regulation Section indicates will be in compliance with the provisions of Public Law 518 under varying conditions in all parts of the country, when the directions, time limits, and restrictive labeling shown in the tabulations are followed. As we pointed out above, however, certain time limits and restrictions will vary from those appearing on currently registered labeling. Charts are set up for individual pesticide chemicals, which are identified by the well-known common names as well as by an acceptable chemical name, and include a listing of the principal formulations which have been registered for each chemical.

The tabulations on the charts are divided into four columns: uses, tolerances, dosage, and limitations.

1. Under "Uses" will be listed the names of the crops or animals on which the pesticide chemical may be applied. Uses which might cause incidental contamination, i.e., premise treatments, are not considered in this survey.

2. Under "Tolerances or Basis of Acceptance" will be listed the numerical tolerance, a statement that the product has been exempted from the need of a tolerance, a statement that it is safe or that there will be no residues when the product is used precisely as directed, or a term "Restrictive Labeling," which applies to those uses which may leave residues on the forage crop treated but which, because of the restrictions placed upon them, will not result in contamination of milk or meat.

3. Under "Dosage" a single pattern dosage will be given in terms of the weight of the active chemical per acre of treated crop, unless otherwise designated. Usually this figure will be the maximum dosage accepted for registration, although this is not necessarily true in every case.

4. Under "Limitations" will be listed any specific directions for use which must be applied to insure that the dosage given will not exceed the tolerance or will leave no residue on the crop involved.

It has not been possible within the scope of this survey to include all acceptable doses and related limitations. Consequently, the single dosage and its specific limitations should be considered a pattern of usage which will be free from the danger of causing illegal residues. The user of the charts, therefore, may logically assume that any uses involving the dosage given, but with a longer time limit, for example, or a lower dosage with the same time limits, would be equally free from danger. It is entirely possible that higher dosages with longer time limits or lower dosages wtih shorter time limits would also be free from danger, but to be acceptable for registration such deviations from the pattern would need to be supported by adequate residue data.

In this connection a pesticides-on-food use not shown in the present charts may be cleared for inclusion in a future revision in one of the following ways:

1. Through the establishment of a tolerance under the Federal Food, Drug, and Cosmetic Act for residues from such use.

2. Through the establishment of an exemption from the requirement of a tolerance under this Act for residues from such use.

3. Through the submission to the Pesticide Regulation Section of a statement from the Food and Drug Administration that the pesticide chemical is not a poisonous or deleterious substance but is safe for use.

4. Through the submission of adequate information to show that there will be no residue on the harvested raw agricultural commodity when the pesticide chemical is used as directed.

The summary will be available for distribution sometime in April. A copy will go to each registrant of an economic poison under the Act. Supplies will be given to the Experiment Stations Division and to the Federal Extension Service for distribution to State administrative personnel. Copies will also be furnished to the various trade associations and publications. The Department asks that requests for copies be delayed until the initial mailing has been completed.

•

Deaderick Succeeds Loomis

The Bemis Bro. Bag Co., St. Louis, has named F. V. Deaderick to succeed C. W. Loomis, who retired recently as vice-president, company director, and director of personnel.

Mr. Deaderick, is replaced as eastern operations director by R. V. Scott.

New Herbicides Take Spotlight at Potomac Phytopath Meeting

SEVERAL promising new chemical plant pest control possibilities were brought to light at a recent meeting of Eastern States plant pathologists, when the Potomac Division of the American Phytopathological Society met at the U. S. Plant Industry Station, Beltsville, Md., on February 28-March 1.

Here are highlights of some of the chemical control experiments reported at Beltsville:

Nemagon, the slow-acting soil fumigant, proved effective against two parasitic nematodes that attack strawberries. O. D. Morgan of the University of Maryland reported that side-dressing mother plants of the Robinson variety in the fall significantly reduced damage to daughter plants. Twenty per cent dry nemagon was used at rates of 68 and 136 pounds per acre. The percentage of root knot (caused by *Meloidogyne hapla*) was reduced from 67 per cent without treatment to 2.8 and 2 per cent with the low high nemagon treatments.

Irrigation increases losses of tomatoes to anthracnose disease and of potatoes to seed piece decay, according to plant pathologists P. J. Lloyd and D. F. Crossan of the University of Delaware. Their tests also showed that maneb and zineb fungicides, applied the day before irrigation, gave good protection against anthracnose infection. These two fungicides also reduced anthracnose infection of non-irrigated tomatoes. Potato seed piece decay in irrigated plots was controlled effectively by treating seed pieces prior to planting with captan, with streptomycin, and with both liquid and dust mixtures of captan and streptomycin.

These two Delaware scientists also proved the value of disease forecasting as a means of achieving timely, effective control with a minimum of chemical. In trials aimed at developing practical control measures for downy mildew of lima beans, Crossan and Lloyd timed treatments with several different chemicals to correspond with forecast information. In one instance, they applied three sprays at seven day intervals, when downy mildew was forecast, and in a second trial, they applied two sprays, 12 days apart after the diseases appeared. In both cases, best control was achieved with the fungicide maneb. In the first trial, the use of maneb sprays at the rate of 2 pounds of Manzate in 100 gallons of water per acre resulted in only 1 per cent infection and shelled lima bean yields of 3,991 pounds per acre. The yield from untreated plots was 1,842 pounds. In the second trial, downy mildew infection in the maneb-treated plots was 0.4 per cent and the per acre yield was 3,819 pounds of shelled beans. The untreated plots showed 38 per cent infection and yielded only 2,523 pounds of beans. Fungicides used in both series gave better control when sprays were timed by forecasting. With basic copper sulfate, 4 pounds in 100 gallons, infection in the forecast plots was 2 per cent, in the plots sprayed after appearance of the disease infection was 9 per cent. Corresponding figures for streptomycin, at a concentration of 100 parts per million plus 1 per cent glycerin, were 14 per cent in the forecast plots and 25 per cent in the non-forecast plots.

A U. S. Department of Agriculture scientist, H. R. Powers, Jr., reported that the antibiotic, anisomycin was effective in eradicating powdery mildew infection from wheat, but that apparently it was not systemic in its action. Eradication was accomplished with antibiotic sprays as long as seven days after infection. Microscopic examination two hours after spraying showed that the growth of the fungus on the leaf had already been destroyed by the antibiotic. However, Mr. Powers said, growth which had penetrated into the next layer of plant cells appeared to be unchanged.

M. A. Sayed and J. W. Neuberger found that the optimum temperature for development of each of the three organisms—the black rot fungi *Botryoshaeria ribis* and *Physalospora obtusa*, and the brown rot fungus *Monilinia fructicola*—was 82 degrees F. Best growth occurred in the temperature range of 68-98 degrees for *B. ribis*, and between 68-82 degrees F. for the other two. Tests with captan, zineb, and captan-zineb combinations against these organisms showed the chemical to be most effective at the maximum and minimum growth temperatures of the diseases. A captan-zineb mixture gave the best control of *B. ribis*; captan was best against *P. obtusa* and *M. fructicola*. He said that the widespread distribution of the disease can be attributed to the unrestricted movement of propagation materials; that the rapid dissemination within plantings can be ascribed to insect carriers. Tests at Beltsville have shown that the virus can be "masked" in the sweetpotato roots, becoming evident only with the first surge of top growth. In other words, healthy appearing roots, carrying the virus, are undoubtedly being transported into and out of all of the major sweetpotato-producing areas of the United States. To test the rapidity of virus spread in the field by insects, Hildebrand planted every third row to virus-infected plants; the two intervening rows to virus-free sweetpotatoes. Examination of roots after harvest showed the diseased rows to be 87 to 95 per cent infected. Infection in adjoining rows ranged from 28 to 45 per cent.

W. Heuberger
councilor

K. W. Kreitlow
president

J. G. Moreman
secy-treasurer

L. O. Weaver
vice president

YOU INCREASE PROFITS WHEN YOU USE

TRIANGLE BRAND COPPER SULPHATE

IN YOUR FUNGICIDE AND FERTILIZER FORMULATIONS

Since 1885, successful growers have preferred Triangle Brand Copper Sulphate in fungicides. It has consistently proved itself more effective and superior to organic materials, in sprays, where Bordeaux Mixture is the most reliable, or in dusts, if preferred.

In mixtures and emulsions, it is compatible with virtually every other pesticidal material. In fertilizers, it is important for enrichment of the soil and its use guarantees larger, healthier and more profitable crops. Forms of Triangle Brand Copper Sulphate available are:

INSTANT (powder) for quick and efficient mixing of Bordeaux sprays.

DIAMOND (snow) small or large crystals, all containing 25.2% metallic copper.

BASIC Copper Sulphate in powder form, containing 53% metallic copper.

Contact us today for further information on TRIANGLE BRAND COPPER SULPHATE and its use in your agricultural formulations.

PHELPS-DODGE
REFINING CORPORATION
300 PARK AVE., NEW YORK 22, N.Y.
5310 W 66th STREET, CHICAGO 38, ILL.

After six days of gibberellic acid treatment in Lilly labs, the peas at left outgrow untreated plants at right by four inches.

Subject: GIBBERELLIC ACID

For the past few years, Lilly has studied the effect of gibberellic acid on plants and seeds. Some of the work now underway is shown on these pages. The results are promising and the work has been intensified.

Our research shows that this remarkable compound can increase growth, speed germination, induce flowering, break dormancy and cause certain other beneficial actions. Our development teams are compiling important data concerning the nature of gibberellic acid and its characteristics in product formulation and use.

Since September of 1956, we have been able to supply research samples to more than 300 other scientific groups. As one of the major basic manufacturers of fermentation products, we expect to produce an adequate and dependable supply to meet the growing demand for gibberellic acid products. It is our intention to make these products available as rapidly as necessary research and development will allow.

AGRICULTURAL & INDUSTRIAL Lilly PRODUCTS DIVISION

ELI LILLY AND COMPANY, INDIANAPOLIS 6, INDIANA

Field plots at the Lilly Agricultural Research Center have been the site of extensive gibberellic acid studies. Here the material is being tested under field conditions with careful measurement of results throughout the growing season.

Flowers and ornamentals are treated in Lilly test plots to gauge the effect of the gibberellic acid compound on flowering, stem length, color, etc. Minute quantities have been found effective and can be applied by several different methods.

A Lilly scientist checks growth and production of field and vegetable plants in the test plots which have been sprayed with gibberellic acid. Results indicate possible use in numerous crops and also in the growing and treatment of many seeds.

Turf plots at Lilly indicate that gibberellic acid causes grasses to grow faster and longer. Even in mid-November the treated plot at the left, after one spraying, had a greener appearance than the untreated grass at the right.

Lilly development teams test gibberellic acid to determine its characteristics in combination with other materials and under a variety of heat, light and moisture conditions. A number of forms of the material are studied for different needs.

Gibberellic acid is the product of a fermentation process which has long been used at Lilly's. As a major basic producer of fermentation products, Lilly has assigned a part of these large-scale facilities to gibberellic acid production.

AGRICULTURAL & INDUSTRIAL PRODUCTS DIVISION

CELA
BHC
LINDANE
CHLORDANE
2-4-5-T
basic
CELA
CELA G.M.B.H. INGELHEIM AM RHEIN
GERMANY.

Texas Agricultural Conference

The place of chemicals in West Texas agriculture, with emphasis on practical problems in production was surveyed on the campus of Texas Tech in Lubbock at the recent fourth annual Agricultural Chemicals Conference.

More than 400 agricultural chemical dealers, distributors, processors, manufacturers, Tech agriculture students and other interested persons attended sessions of the two-day meeting which was sponsored by Texas Tech, the A&M College System of Texas, the Lubbock and West Chambers of Commerce.

Speaking on "Can I Grow 3 Bales of Cotton per Acre," T. Siek, J. G. Boswell Ranch, Marienette, Ariz., told conference participants that in Arizona his organization had succeeded in growing two and one-half bales of cotton per acre. He urged good cultural practices, variations and management to get full value from agricultural chemicals in raising cotton.

Cameron Siddall, Pennsylvania Salt Manufacturing Co., Bryan, Texas spoke on the Miller Amendment passed in 1954, and William B. Ennis, U.S.D.A., Beltsville, Md., reviewed the national research program for weed control.

Dr. W. O. Trogen, agronomist with the Olin Mathieson Chemical Co., Houston, discussed fertilizers as they fit into the overall picture of agriculture. Main trends of the Trogen discussion were on foliar feeding and liquid applications of plants. To date, materials applied to leaves are restricted because of the expense involved, he said.

Speaking on insecticides, Dr. J. G. Watts said, "Over 40 species of insects have developed a resistance to insecticides. As long as we use large quantities of insecticides we can expect insect resistance to them to increase. In many cases this resistance is inherited by offspring of insects." He urged expanded research for new chemicals and re-evaluation of old ones which have been discarded.

Presiding over meetings were Dr. W. L. Stangel, Tech School of Agriculture dean, Dr. A. W. Young, Tech agronomy department head, and Dr. John S. Rogers, Texas A&M agronomy department head.

Equipment demonstrations and exhibits of agricultural chemical machinery and equipment were also held at the Tech Agronomy Farm and the Tech Agricultural Engineering Building Annex.

•

Nitrogen Div. New Fertilizer

The Nitrogen Division of Allied Chemical & Dye Corp., New York, has begun production of pebbled ammonium nitrate fertilizer in new facilities at its Hopewell, Va., plant.

The company has been making liquid ammonium nitrate and other nitrogen solutions for a number of years. In the new facilities, liquid ammonium nitrate is dehydrated, pebbled, coated, bagged and shipped.

•

U.S.I. Plant Operating

A new phosphoric acid plant has been completed by the U. S. Industrial Chemicals Co., New York, at Tuscola, Ill., with a production capacity of 30,000 tons per year.

The "wet process" phosphoric acid is made from phosphate rock and sulfuric acid in the new plant which uses a process licensed from S. A. Metallurgique de Prayon, a Belgian company. The sulfuric acid used in the plant is "spent" acid from the neighboring plant of National Distillers Products Corp.

•

Texas Gulf Elects Two

The election of Claude O. Stephens as president of the Texas Gulf Sulphur Co., New York, was announced recently by the board of directors. Mr. Stephens succeeds Fred M. Nelson, who was elected chairman and will continue as chief executive officer.

•

SNC Produces At New Plant

Southern Nitrogen Co., Inc., Savannah, Ga., has entered the first stage of production at its new $14,000,000 nitrogen manufacturing plant in Savannah. The plant now produces ammonia and nitrogen manufacturing solutions. It will be producing solid "Dixie" ammonium nitrate by this month. Ammonia capacity is 250 tons a day.

Pilot School Held at MSU

What are the advantages of quality control?

Can small companies afford it?

A school for small business was held at Michigan State University on February 11 and 12, sponsored by both M.S.U. and the Scientific Apparatus Makers Association (S.A.M.A.). Its purpose was to acquaint small manufacturers with the advantages of establishing a chemical quality control laboratory in their business. While the attendance was smaller than anticipated, those present were enthusiastic about the manner in which the program was carried out.

This pilot school may be considered an experiment in educating small enterprises capitalized at $500,000 or less. Members of the Michigan State University faculty cooperated with S.A.M.A. in organizing and conducting the school. Such questions as those above introducing this article were discussed. Two well-qualified faculty members briefly but effectively described what statistical quality control is and how it can be adapted to any manufacturing process to reduce customer complaints, cut production costs and reduce the number of inspections without reducing quality. Another faculty member outlined the manner in which a quality control laboratory is designed and emphasized the qualities needed by the chemist in charge.

The cost of a control laboratory for a small concern need not exceed $5000 for basic equipment and instruments. The overhead for materials, reagents, flasks, test tubes and so on would add another $1500 per year per technician. This laboratory would begin by testing the quality of raw materials and then work into the procedure of statistical quality control of the finished product. In time such a laboratory could be developed to do research to improve current products and undertake to develop new ones.

Small fertilizer and pesticide formulators could advantageously establish the type of laboratory discussed above as a vital aid in maintaining a high quality product.

Davison Unveils 2 Products

The Davison Chemical Co., division of W. R. Grace & Co., Baltimore, will introduce two products for the garden and lawn fertilizer markets this year.

Nurish, a water-soluble plant food for lawns, flowers, vegetables, and greenhouses will be offered in middle western cities this spring. Wonder-Gro, a granulated fertilizer especially formulated for lawns and ornamentals, will also be promoted for the home fertilizer market.

•

Agr. Legislation Meet

A statewide conference on agricultural legislation, sponsored by the California State Chamber of Commerce, was held in Sacramento, Calif., on March 6. The stated purpose of the conference was to emphasize the inter-dependence of agriculture and legislation; to analyze current important legislative issues relating to agriculture; and to bring into focus the importance of agriculture as it relates to legislation, and the importance of legislation as it relates to agriculture.

•

Cal-Spray Moves Office

The California Spray-Chemical Corp., Richmond, Calif., has moved district offices and warehousing from Caldwell, Idaho, to Salt Lake City, Utah. The new headquarters will be the central base of operations in the Mountain West area for the sale and distribution of Calspray's Ortho insecticides, fungicides, and plant foods.

•

Westvaco Expanding Plant

An expanding program is being undertaken at Food Machinery & Chemical Corporation's largest chemical installation, the Westvaco Chlor-Alkali Division plant at South Charles, W. Va. The expansion involves carbon bisulfide and carbon tetrachloride, two major Chlor-Alkali products.

•

Comm. Solvents Elects 2

The Commercial Solvents Corp., St. Louis, has announced the election of J. Fred Dudley and Graham W. McMillan as vice presidents.

Mr. Dudley heads the company's production and engineering activities and Mr. McMillan is responsible for research and development and the operation of the central research laboratories at Terre Haute, Ind.

•

Nichols Firms Merge

The Nichols Seed Co. and the Nichols Fertilizer and Chemical Co.,

Earl Nichols J. I. Taylor

both of Oklahoma City, have merged to form the Nichols Seed and Fertilizer Co.

Earl Nichols, former president of the fertilizer and chemical company, is president of the new organization and John I. Taylor is general manager.

•

Pennsalt Appoints Miller

Allen E. Miller has been appointed general purchasing agent for the Pennsylvania Salt Manufacturing Co., Philadelphia. He succeeds Fred G. Prince, who is on leave of absence to the U. S. General Services Administration in Washington, D. C.

•

Triangle Marks 30th Year

The Triangle Co., Salinas, Calif., is celebrating its 30th year of operation in 1957 and was joined in marking the anniversary by the local newspaper, the Salinas Californian, which devoted a special section to the agricultural chemicals concern.

The 32-page supplement contained photographs of the personnel and facilities of the Triangle Co., as well as stories about the company's background. The paper also printed a biography of W. E. Simas, Triangle president and founder.

Mr. Simas started the business in the Salinas Valley, at the same address it has today, when he anticipated the demand for fertilizers needed to restore lands being depleted by the lettuce crops 30 years ago.

RN Liquid Fertilizer Plant

Rn Fertilizer Company, Akron, Michigan, started operation last month of their liquid fertilizer plant. The plant has a production of about 20 tons per hour and during peak seasons is expected to run at 10 to 12 hours per day.

Harry Rohlfs and Stanley Smith are the owners and Bill Anderson is the plant manager. The plant was designed by J. C. Carlile Corp., Denver.

•

Kansas Pesticide Meeting

More than 175 persons attended the first state pesticide dealer and custom applicator conference held at Kansas State College, Manhattan, Kans., last month. The program included talks on weeds, insects, and nematodes by specialists from the college, the state board of agriculture, and the USDA research services.

The experts discussed the safe use of pesticides, controlling weeds and brush in fields and pastures, research on spotted alfalfa aphids and corn earworms in grain sorghum, and a forecast of the insect situation for 1957.

•

Potato Research Grant

A grant for the support of fundamental research on potato nutrition has been given Dr. H. W. Gausman, University of Maine and Maine Agricultural Experiment Station. The grant was made by the National Science Foundation. Dr. Gausman's study will involve an investigation of the direct contribution of chlorine to plant growth and of the relationship to chlorine to other essential nutrients.

•

Du Pont To Up Urea Output

Planned expansion of production facilities for "Uramon" ammonia liquors at Du Pont's Belle Works in West Virginia are expected to be completed in 1959. In conjunction with plant modernization, the company is expanding its research in the development of new ammoniating formulations.

Among the goods now produced at the Belle Works are urea for fertilizers, ammonia, and cattle feeds.

Crop Protection Congress

The Fourth International Congress of Crop Protection, Scheduled to be held in Hamburg, Germany, from the 8th to the 15th of September, 1957, will present a review of the progress made during the last five years in the field of phytopathology and crop protection.

Persons who are interested in attending the conference and/or delivering a paper have been asked to communicate with the congress office. Topics of papers should be announced before April 1.

The following subjects will be discussed during the congress; fundamental research, phytotherapy, protection of stored products, technique of crop protection, plant quarantine, and organization of crop protection and legal regulations.

•

Cyanamid Builds In Canada

American Cyanamid Co., New York, has announced that its Canadian subsidiary, North American Cyanamid, Ltd., will build Canada's first plant to produce urea.

The plant will be situated on the bayfront at Hamilton, Ont., and is scheduled for completion by mid-1958. The initial production capacity will be 52,500 tons of anhydrous ammonia and 66,000 tons of urea annually.

•

Field Specialist Appointed

Walter Miller has been appointed field specialist in agricultural chemical development for The Dow Chemical Co., Midland, Mich., in the five-state area which includes Alabama, Louisiana, Mississippi, Arkansas and Tennessee.

He will make his headquarters in Greenville, Miss., and will be engaged in research and development work on insecticides, soil fumigants, and commodity and space fumigants.

•

Israel to Ship Fertilizers

Internationalization of the Gulf of Aqaba will open the Far East to fertilizer shipments, it was reported last month in *The New York Times*. The *Times* report says: "Israel's chemical industry will be able to supply Far East countries with needed fertilizers. Potash from the Dead Sea would go as far as Japan and a new prosperous era would begin for Israel, which has been struggling for years to maintain her economy."

•

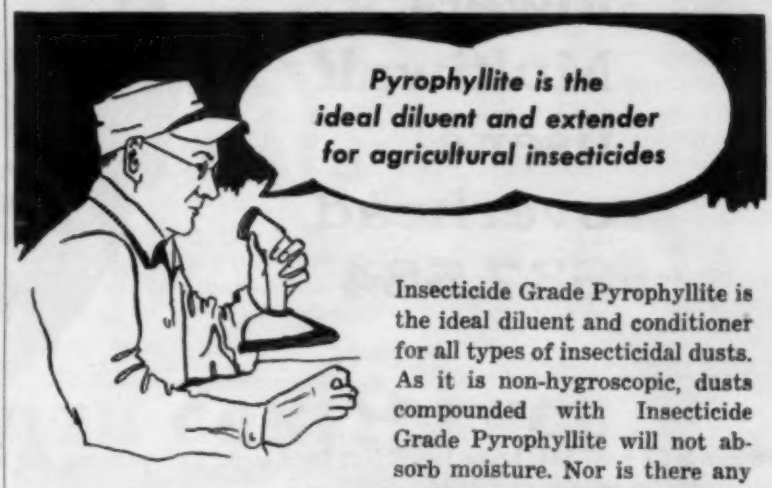
New Potash Unit Opened

The National Potash Co., New York, has placed in operation its new potash mine and refinery near Carlsbad, N. M. The facilities include two 1,800-feet shafts, believed to be the deepest in the potash industry.

Naugatuck Shifts Two

Two changes in the executive staff of the Naugatuck Chemical division, United States Rubber Co., New York, have been announced by George R. Vila, newly elected vice president and general manager.

Earle S. Ebers, formerly general sales manager, has been appointed assistant general manager of the division, and Harold M. Parsekian, who was assistant general sales manager, has been named general sales manager.



Glendon's Insecticide Grade Pyrophyllite

Wt per cubic foot—30 lbs

92 to 95% will pass a 325 mesh screen

pH range of 6 to 7

Non-alkaline and chemically inert

Average particle size below 5 microns

Insecticide Grade Pyrophyllite is the ideal diluent and conditioner for all types of insecticidal dusts. As it is non-hygroscopic, dusts compounded with Insecticide Grade Pyrophyllite will not absorb moisture. Nor is there any tendency even during extended storage, for the carrier to separate from the active ingredients.

Insecticide Grade Pyrophyllite has superior adhering properties, and because it is difficult to wet, it holds well on the plant leaves even during rain. When used as a carrier for products to be dusted by airplane, it settles rapidly, minimizing drift, waste of materials, etc.

Send for Testing Samples

GLENDON

Pyrophyllite Company

P. O. Box 2414

Greensboro, N. C.

Plant & Mines, Glendon, N. C.

THE MAN WITH THE ★ MULTIWALL PLAN

UNION PACKAGING SPECIALIST BLAINE LOUDIN

lowers a Multiwall user's overhead $37,584

66 minus 27 = 37,584. Loose logic? Not for a large agricultural chemicals' firm whose Multiwall Packaging and materials handling system was recently reviewed and revised by Union Packaging Specialist Blaine Loudin.

The 27 represents a reduction in the company's labor force from an original staff of 66. The 37,584 . . . seasonal dollar savings achieved following adoption of Union's recommendations for more efficient, economical operation.

Union Multiwall Recommendations are based on this 5-star Packaging Efficiency Plan

- DESIGN
- EQUIPMENT
- CONSTRUCTION
- SPECIFICATION CONTROL
- PLANT SURVEY

Among the new proposals: using a lateral bag conveyor for carloading. This improvement alone speeded handling and freed three men for other plant work.

The complete changeover was made using existing equipment and buildings with only slight modifications. Capital outlay expended by the company was paid back in less than 13 months.

This is a typical case of Union's 5-Star Packaging Efficiency Plan in action. Write for full information.

Better Multiwall performance through better planning

union camp

UNION'S PACKAGE ENGINEERING DEPARTMENT will study your Multiwall bagging methods and equipment and make appropriate recommendations, regardless of the brand of Multiwalls you are now using.

UNION MULTIWALL BAGS

UNION BAG-CAMP PAPER CORPORATION

233 BROADWAY, NEW YORK 7, N. Y.

N.P.F.I. Projects Told

The National Plant Food Institute, Washington, D. C., is sponsoring projects with educational institutions for three Western states. The projects are designed to "focus attention on the importance of using fertilizer more efficiently."

The projects are: production of a leaflet in cooperation with Washington State college, entitled "Soil Testing is Good Business"; production of a large color poster with the advice and assistance of Oregon State college, focussing attention on soil testing and the proper use of fertilizer; and the arrangement with the Bureau of Agricultural Education, California State Department of Education, for a $1,500 fellowship at the California State Polytechnic college.

•

Nitrogen Boosts Bluegrass

If bluegrass is top-dressed with nitrogen it will produce five times more early-season pasture than untreated bluegrass, according to tests conducted by the University of Illinois. The Illinois researchers pointed out that, although the benefits of nitrogen last less than a month, the bluegrass serves as early-season pasture until regular pasture is ready.

•

Fertilizer Plant For Turks

Nitrogen Industries Ltd., a Turkish company, is constructing a fertilizer plant at Kutahya in western Turkey. The new plant will have an annual production capacity of 60,000 metric tons of ammonium sulfate, 50,000 tons of nitrate, 6,000 tons of concentrated nitric acid, 1,000 tons of crystallized ammonium nitrate, and 1,000 tons of liquid ammonia.

•

New Arkansas Bromine Plant

Michigan Chemical Co., St. Louis, Mich., in a joint venture with Murphy Corp., El Dorado, Ark., has placed in operation a new bromine plant at El Dorado.

The company expects to maintain the price level in effect at the end of 1956 as an encouragement to a wider use of bromides by chemical manufacturers.

Monsanto Ammonia Sales Off

The decrease in earnings of Monsanto Chemical Co., St. Louis, during 1956 was caused largely by a drop in sales and earnings of the ammonia operations of its Lion Oil Co. division, the company's 1956 corporate report stated.

Drought, crop curtailment, and the relatively unhappy condition of agriculture, were factors advanced by company officials as causing the drop in ammonia sales.

•

New Engineering Firm

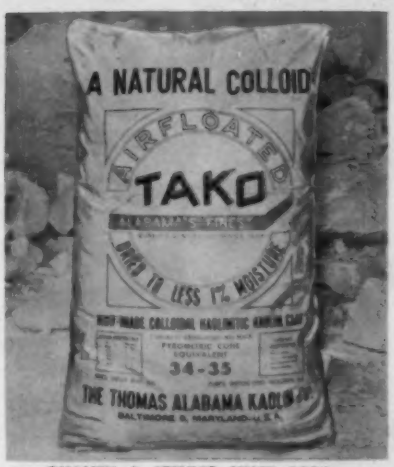
Davidson-Kennedy Co., 69 year old, Atlanta, Ga. manufacturing firm has announced the formation of Davidson-Kennedy Associates. The new firm will act as an engineer-contractor and will carry out the design, procurement of equipment and materials, and erection of chemical process plants and facilties. President of the new firm is Thornton Kennedy, also president of Davidson-Kennedy Company. Offices are in Chicago and Atlanta.

USE WITH CONFIDENCE

UNIFORM QUALITY

"TAKO" Natural High Grade Pure Colloidal Kaolinitic Kaolin Crude from our very extensive deposits is processed by neither adding to nor taking away any of its very desirable properties. Its colloidal properties give increased workability in formulations and its purity is highly desirable due to its compatibility with chemicals.

"TAKO" Airfloated Colloidal Kaolinitic Kaolin is a natural exclusive product—a practically pure inert colloid with exceptional qualities—contains absolutely no mica—practically chemically pure.



"TAKO" — Excellent adhesive-absorption qualities—excels in formulations of insecticides—pesticides—inert colloidal properties increase toxic action—give increased workability—dispersion—free flowing from all types of dusting equipment—absolute minimum drifting.

MICRON SIZE

MINUS	1	MICRON	.....55%
"	2	"	.....68%
"	5	"	.....85%

NO MICA — NO ALKALIES

AIRFLOATED — BAGGED OR BULK

GUARANTEED LESS 1% FREE MOISTURE

DEPENDABLE

PROMPT SERVICE

QUALITY & SERVICE SINCE 1939

Non-abrasive • Non-hygroscopic • Non-caking • Free-flowing

"TAKO" **is produced under complete laboratory control. Large tonnage used by the insecticide-pesticide, fertilizer, chemical, & other large industries.**

THE THOMAS ALABAMA KAOLIN COMPANY

2412 KEN OAK ROAD — BALTIMORE 9, MARYLAND

Plants & Shipping Point — Hackleburg, Alabama

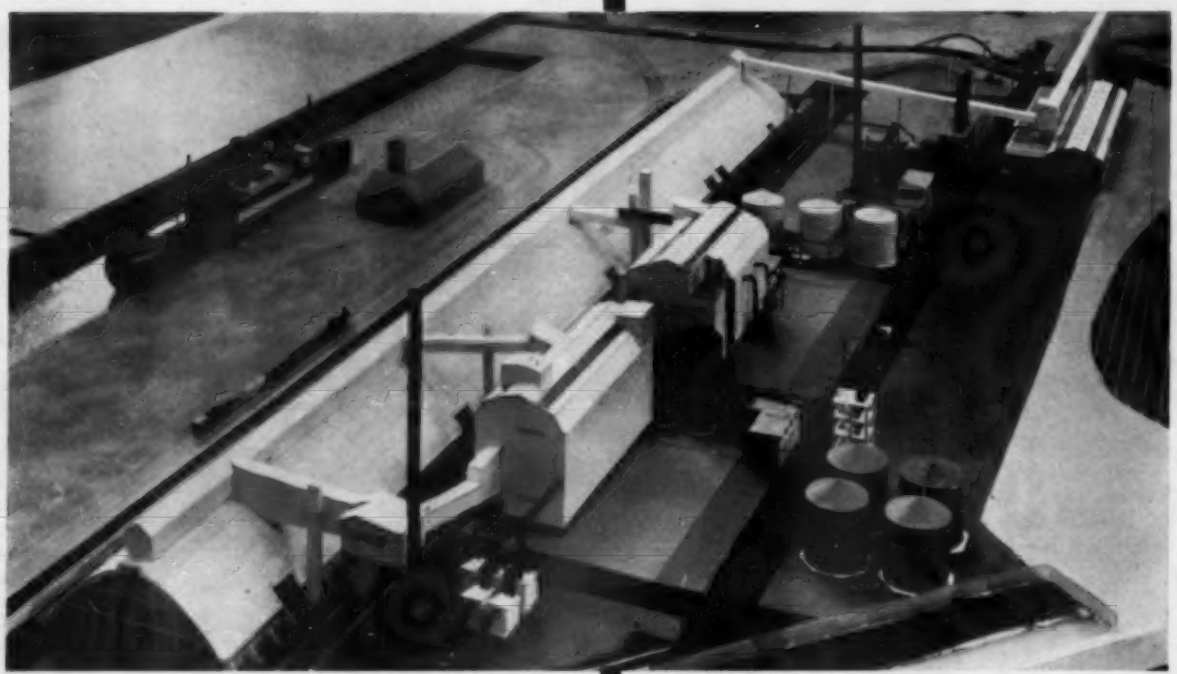
INVESTIGATE "TAKO" FOR YOUR REQUIREMENTS

NEW CONCENTRATED FERTILIZER PLANT

. . . for Scottish Agricultural Industries Ltd. Leith, Scotland

GRANULATION SECTION

designed . . .
engineered . . .
equipped by
DORR-OLIVER INCORPORATED



Model of the Scottish Agricultural Industries Ltd.'s new granular fertilizer plant at Leith, Scotland. The fertilizer granulation unit was designed, engineered, and equipped by Dorr-Oliver Incorporated, Stamford, Connecticut.

Scottish Agricultural Industries Ltd.'s new 8.5 million dollar concentrated granular fertilizer plant at Leith, Scotland, includes three main process units — sulfuric acid production, phosphoric acid production, and a fertilizer granulation unit. The granulation section, designed, engineered, and equipped by Dorr-Oliver Inc., utilizes the worldwide accepted Dorrco Granular Fertilizer Process. In this process muriate of potash, filler, and recycled fines are coated with relatively thin slurries of ammonium phosphate and ammonium sulfate, to form closely sized granules.

Dorr-Oliver's Consulting Engineering Department, with 40 years' experience in the field of concentrated fertilizer production via the wet process of manufacturing phosphoric acid, is staffed by engineers fully qualified to handle all phases of fertilizer plant design — from economic analysis to supervision of initial operation.

If you are considering entering the fast growing fertilizer field — or if you plan to expand present plant facilities — it will pay to check with Dorr-Oliver. Write for a copy of Bulletin No. 8000, or better still, let us send an engineer to discuss your problem from the standpoint of economics and process. No obligation, of course.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

CSC Names O'Leary

James V. O'Leary has been named General Sales Manager for Commercial Solvents Corp., New York. Mr. O'Leary had been sales manager of the company's biochemicals division.

In his new position, Mr. O'Leary is responsible for sales of all the company's products to users of industrial and agricultural chemicals, animal nutrition products, and potable spirits.

•

Formwalt Joins Pennsalt

William S. Formwalt was recently appointed assistant to the vice president of Pennsylvania Salt Manufacturing Co. of Washington, Western Division, Tacoma, Washington. He was formerly associated with Davison Chemical Co., Baltimore, and has experience in sales of sulfuric acid and phospate rock.

•

500 Attend NALI Meet

Over 500 members and guests of the National Agricultural Limestone Institute convened in Washington, D. C. for the organization's 12th annual convention in February. A panel of top U.S.D.A. officials headed by E. L. Peterson, assistant secretary, discussed the nation's conservation problems and Senator Karl E. Mundt, of South Dakota, delivered an address on the conservation problem and the part that the Agricultural Conservation Program plays in their solution.

"It is imperative to our national success not only that our crops have good growth," Senator Mundt said, "but also that our good crops are food for something. Good food, adequate nutrition, a balanced diet, these results are encountered by proper and appropriate use of limestone and other supplements to our soil," the senator concluded.

•

Soil Builder From Bark

Scientists at the Armour Research Foundation, Chicago, report that they have developed a method of converting bark into an inexpensive and unusually effective soil-builder.

Dr. C. Roland McCully, scientific advisor at the foundation, said the soil-builder loosens the soil and improves its moisture-holding capacity, serves as a base for fertilizer, and controls the rate at which the plants obtain food from the soil.

•

Baldwin Joins Fulton

Jack C. Baldwin has been named Western Director-National Accounts for the bag division of Fulton Bag & Cotton Mills, New Orleans. Mr. Baldwin maintains headquarters at the company's plant in Los Angeles, Calif.

Favor Witchweed Quarantine

Farmer representatives from eight counties in North Carolina and South Carolina, where witchweed has been found, went on record as favoring a Federal quarantine against this recently discovered pest of corn and other crops at a public hearing called by the U. S. Department of Agriculture in Washington, D. C., March 5.

This meeting was the second and final session of a hearing initially convened on January 30 in Washington to consider establishment of a Federal

MORE FOR YOUR MONEY

FF ABSORPTIVE CLAY

HIGHLY ABSORPTIVE

PRODUCES DRY FREE FLOWING 40% CONCENTRATES OF LIQUID OR SEMI-SOLID TOXICANTS.

F.F. ABSORPTIVE CLAY WILL DO THE JOB,—WHETHER YOU GRIND OR IMPREGNATE

THOROUGHLY PROVED DURING THE PAST SEASON BY NUMEROUS USERS THROUGHOUT THE SOUTHEAST

NOW READY TO SERVE AND SAVE IN OTHER AREAS.

PROPERTIES

Composition	Aluminum Silicate
Bulk Density	30-32 lbs./cu. ft.
Fineness	85% Min. 325 mesh or 90% Min. 325 mesh
pH	4.5
Packing	50 lb. Multiwall Bags

PALLETIZED OR UNITIZED FOR FORK TRUCK HANDLING AT SLIGHT EXTRA CHARGE

ALSO AVAILABLE AS GRANULES

For further information and samples write or call

NATIONAL KAOLIN PRODUCTS CO.

P. O. Box 431 Aiken, S. C. Phone 9-3431

Cash in Now on This Amazing Plant Growth Discovery

NEW!

GIBREL*

Makes Plants Grow Faster and Bigger Than Ever Before Possible

RESULTS SHOWN IN RESPONSIVE ORNAMENTALS, TREES, TURF, FOOD AND FEED CROP PLANTS

1. Plants grow faster, mature earlier—those requiring "long-days" for blooming, flower early.
2. Size and bulk are greatly increased.
3. Blooms are heavier, and yields are higher.
4. Grasses grow faster, more luxuriantly than with fertilizer alone.
5. Flowering time is advanced—certain biennials bloom in the first year, some annuals bloom as much as five weeks earlier.
6. Seeds are produced earlier, in as little time as six months in such plants as carrots and head lettuce.
7. Dormancy is broken. The requirements for rest period, cold treatment, or variable day length are often by-passed completely.
8. Plants are not set back after transplanting.
9. Fruit set is improved.

GIBREL is the first of the gibberellins to be produced on a commercial scale. It is ready for immediate use in your formulations. Completely unrelated to fertilizers or nutrients, this Merck-developed gibberellin salt is making headlines with its indicated uses in flowers, ornamentals, turf grasses, and trees. Extensive tests indicate phenomenal results in food and forage crops. Chronic toxicity studies, however, have not yet been completed. Therefore, recommendations for use on such crops must await final results of these tests.

GIBREL for Higher Profits

You can start building profits right now with products containing GIBREL. And you can count on Merck—the first basic producer of a practical gibberellin—to assist you with technical and marketing problems.

© Merck & Co., Inc.

GIBREL Heavily Advertised

Merck promotion is pre-selling GIBREL to your customers through a heavy national advertising and promotion campaign. In addition, Merck research is continuing its program to get additional uses for GIBREL. As always, Merck technical service is prepared to aid you in developing your new product, or in adding GIBREL as an ingredient to your present formulation.

GIBREL Easily Formulated

You may use GIBREL in aerosols, powders, and other dry formulations. GIBREL may be present as the only active ingredient or combined with soluble nutrients. Dry GIBREL is stable, readily soluble in cold water, and noncorrosive.

GIBREL Now Ready for Shipment

Merck supplies GIBREL in ¼ and ½ lb. containers, and as a 10 per cent pre-mix in 2½ and 5 lb. containers. For technical data, prices, or samples of GIBREL, call, wire, or write—
Merck & Co., Inc., Chemical Division, Rahway, N. J.

*GIBREL is the trademark of Merck & Co., Inc. for its plant growth substance.

GIBREL*—a product of MERCK

MERCK & CO., INC.
CHEMICAL DIVISION
RAHWAY, NEW JERSEY

quarantine to prevent the spread of witchweed from known infested areas in the Carolinas. The pest was discovered there last fall for the first time in the United States.

•

Packaging Show April 8

More than 1,000 specialists in packaging, shipping, traffic management, materials handling, and merchandising are expected to attend the American Management Association's 26th Annual National Packaging Conference at the Palmer House, Chicago, April 8 to 10. The conference program will explore the entire packaging field and will feature almost 400 exhibits.

Among the manufacturers who will be represented at the conference are: Bemis Bros. Bag Co., The Burlap Council, of the Indian Jute Mills Assn., Continental Can Co., Eastman Chemical Co., Olin Mathieson Chemical Corp., Union Bag Camp Paper Corp., and E. I. du Pont de Nemours & Co.

•

Two Join A.A.C. Staff

A chemical engineer and an organic chemist have joined the staff of the research and process development department of the American Agricultural Chemical Co., New York. James A. Taylor has been named research chemical engineer and Bernard Buchner has been named research organic chemist.

•

Quebec Office For Chipman

Chipman Chemicals Ltd., Hamilton, Ont., has opened a Quebec sales office and pesticides warehouse in Montreal. Guy Hamilton is in charge of the office which serves the entire province of Quebec.

•

Dismiss Bag Patent Suit

The patent infringement suit against the Everglades Fertilizer Co., of Florida, has been dismissed by the District Court of the United States for the Southern District of Florida, Miami Division, after two years of litigation.

Judge Joseph P. Lieb granted a motion for summary judgment to the Everglades Fertilizer Co., who had been accused by Inglett & Corley, Inc., of Georgia, manufacturer of the I & C Bagger, of patent infringement. Everglades had purchased a Kraftpacker Open Mouth Bag Filling Machine from Kraft Bag Corp., New York, in Nov. 1954.

The motion for summary judgment was issued in favor of Everglades because the court found "no genuine issue as to any material fact and that as a matter of law plaintiff's patent is invalid by virtue of prior public use."

False Advertising Order

The Federal Trade Commission recently approved an order requiring Foreign Products Corp., East Orange, N. J., and George Dugdale, trading as the Burkleigh Co., Towson, Md., to stop misrepresenting the qualities of Actumus, a soil conditioner they sell.

The cease and desist order is based on the examiner's findings that the companies have claimed falsely that Actumus: (1) is humus, (2) ac-

New Modern Plant Where SER-X is Produced

SER-X is a potassium hydrous alumina silicate of the following analysis: SiO_2 73.08%, Al_2O_3 13.70%, Fe_2O_3 3.12%, TiO_2 0.54%, CaO 0.30%, MgO 1.14%, Na_2O 0.22%, K_2O 5.42%, Ign. Loss 2.54%, Fusion Point Cone 12.

Processed from Sericite ore, **SER-X** has an average particle size of 3.5 microns and a bulk density of 40 pounds per cubic foot. **SER-X** is inert, non-hydroscopic and non-shrinking. The particles are flat. Because of these physical and chemical properties it has proved ideal as a diluent in the formulation of agricultural insecticide dusts.

For Technical Literature and Samples, Write Dept. AC 1

The SUMMIT of QUALITY *

The Test Proven Insecticide Diluent

Formulators Report Excellent Results

* Registered Trade Mark

SUMMIT MINING CORPORATION

BASHORE BUILDING CARLISLE, PENNSYLVANIA

D. F. Wicke
New York, N.Y.

W. E. Noble
New York, N.Y.

H. L. Houser
Buffalo, N.Y.

T. C. Splane
New York, N.Y.

R. L. Walters
New York, N.Y.

S. G. Shetter
Middletown, Ohio

R. J. Stevens
Chicago, Ill.

J. J. Greene
Louisville, Ky.

R. G. Roberts
Chicago, Ill.

M. F. Keane
Cleveland, Ohio

W. R. Raleigh
Chicago, Ill.

A. P. Wolfy
Detroit, Mich.

R. T. Brown
St. Louis, Mo.

R. W. Drury
Kansas City, Mo.

Frank Finegan
Kansas City, Mo.

D. D. Young
Des Moines, Iowa

C. A. Dillon
Houston, Texas

T. B. Athey
Baltimore, Md.

Get acquainted with a Packaging Problem-Solver...

Raymond

THE MULTIWALL MAN

...and the Multiwall Men at your service

And . . . as our little man suggests, the Raymond representatives pictured here are practical packaging problem-solvers. Years of experience in the multiwall field backed by the Kraft paper resources of Albemarle and the extensive manufacturing facilities of Raymond, gives you the answer to your problems . . . rapidly and effectively. Raymond men are bag men. They know their product and how to make it work for you. They see to it that the last bag of your order is as crisp and salesworthy as the first. Phone the Raymond Multiwall man nearest you . . . let him show you how you can solve your packaging problem with a Raymond Multiwall!

RAYMOND BAG CORPORATION

Division of Albemarle Paper Mfg. Co.

MIDDLETOWN, OHIO • RICHMOND, VIRGINIA

P. M. Seaman
Philadelphia, Pa.

C. L. Stemen
Charlotte, N.C.

NEW SUBSCRIPTION ORDER

AGRICULTURAL CHEMICALS

☐ 2 YEARS FOR $5* OR ☐ 1 YEAR FOR $3*

Company .....

Name .....

Address .....

City .....

Postal Zone State

Subscription Address .....
(If different from above)

*Above rates are for U. S. and U. S. possessions ONLY.
CANADA: $4 [ ] 1 year; $7 [ ] 2 years (payable in Canadian or U.S. funds)
LATIN AMERICA: $4 [ ] 1 year $7 [ ] 2 years
OTHER COUNTRIES: $9 [ ] 1 year $15 [ ] 2 years

TYPE OF BUSINESS

- ☐ Mfrs., mixers, blenders of agri. insecticides, fungicides, fertilizers, weed killers.
- ☐ Distributors or dealers.
- ☐ Custom sprayers, PCO's, farmers, orchardists, nurserymen, etc.
- ☐ Govt. officials, county agents, exp. sta. personnel, libraries, consultants, etc.
- ☐ Suppliers of raw materials, machinery, equipment, etc.
- ☐ Other

Your Title.....

FIRST CLASS
PERMIT No. 80
(Sec. 34.9, P.L.&R.)
CALDWELL, N. J.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

3c-POSTAGE WILL BE PAID BY—

AGRICULTURAL CHEMICALS

P. O. BOX 31

CALDWELL, N. J.

FIRST CLASS
PERMIT No. 80
(Sec. 34.9, P.L.&R.)
CALDWELL, N. J.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

3c-POSTAGE WILL BE PAID BY—

AGRICULTURAL CHEMICALS

P. O. BOX 31

CALDWELL, N. J.

NOTICE TO PUBLISHER OF CHANGE OF ADDRESS

Please change the address for my copies of
AGRICULTURAL CHEMICALS

FROM .....
(Street Number, Apt. Number, P. O. Box Number or RFD Number)

.....
(City) (Zone Number) (State)

.....
(Show any numbers or dates included in address on copies for identification)

TO .....
(New Address—Street and No., Apt. No., P. O. Box No., or RFD Number)

.....
(City) (Zone Number) (State)

NAME ..... Date .....
(As it appears on your magazine)

tivates bacteria which create nitrates, (3) creates fertility in the soil, and (4) is entirely natural and 100 per cent organic.

•

Am. Potash Plant In Miss.

The American Potash & Chemical Corp., Los Angeles, is building a $5 million chemical manufacturing plant at Aberdeen, Miss., for the production of sodium chlorate.

Construction is under way at a 586-acre site on the Tombigbee River, with completion scheduled for mid-1958. The new facility marks AP & CC's first venture east of the Mississippi River for the manufacture of its Trona electrochemicals.

•

Miss. Crop Dusters Elect

The Mississippi Aerial Applicators Association re-elected their 1956 slate of officers at the organization's first annual convention held at the Edgewater Gulf Hotel in Biloxi, Miss.

Mabry Anderson of Clarksville is president, Vic Sutter of Greenwood remains as vice president, and Larry Wade is secretary-treasurer.

•

Diamond Appoints Yent

Charles C. Yent, has been appointed manager of manufacturing operations for Diamond Black Leaf Co., Cleveland, Ohio.

In his new post, Mr. Yent is responsible for engineering and production. Diamond Black Leaf has plants in Richmond; Louisville, Kentucky; Montgomery, Alabama, and Des Moines, Iowa.

•

Fertilizers Tested In S. C.

During the past several years 389 South Carolina test-demonstration farmers in 26 countries have received 3,860 tons of highly concentrated phosphate materials from the Tennessee Valley Authority for use on forage crops. TVA ammonium nitrate has also been available during the past three years.

P. S. Williamson, farm management specialist for the Clemson Extension Service, Clemson, S. C., reports that the test-demonstration program has benefited farmers by helping them diversify their enterprises. It has also proved that highly concentrated fertilizer materials can be used successfully under actual farm conditions, according to Mr. Williamson.

•

I.M.C.C. Names Burns

Thomas A. Burns has been appointed area sales manager for the Phosphate Minerals Division of International Minerals and Chemical Corp., Chicago.

He is responsible for sales of phosphate rock for agricultural and industrial uses in northern United States and eastern Canada.

Allied Elects Miller

Glen B. Miller has been elected president of the Allied Chemical and Dye Corp., New York. He succeeds Fred J. Emmerich, who was named chairman of the board.

Mr. Miller joined the company in 1920, the year of its formation, and was elected a vice president in 1930. Mr. Emmerich also joined Allied in 1920. He served as controller and vice president before being elected president in July, 1946.

Four facts for users of absorbent clay

1 **Absorption qualities** of clay can be the cause of production problems and inferior product performance. High absorption qualities automatically assure smoother, more even results in grinding and impregnating all toxicants such as DDT, BHC, Malathion, Toxaphene and many others. Pikes Peak Absorbent Clays are selectively mined and carefully processed to guarantee the superior absorption necessary to maintain your quality production standards.

2 **Compatibility factor** has a direct bearing on the stability of your finished product or concentrate. Pikes Peak Absorbent Clay's pH of 5 delivers a compatibility factor *unequalled* by any other carrier or diluent.

3 **Grinding** requirements frequently differ, depending on the standards of the user. Your needs may vary from those of your competitors. Pikes Peak Absorbent Clay satisfies the basic need for extremely finely ground particles. *Ninety-five percent of every shipment is guaranteed to pass through 325 mesh.* Other sizes of Pikes Peak Clay are available to meet your specific needs.

4 **Service** is the vital factor in many clay purchases. You must have it when you need it. And you must have a source you can depend on to come through on tight schedules as well as during the lull seasons. Write us soon. Put us on the spot. Make us prove clay quality. Demand that we demonstrate what we mean when we say "with Pikes Peak Clay, you get service and quality you can depend on."

PIKES PEAK ABSORBENT CLAY

GENERAL REDUCTION COMPANY

1820 Roscoe St., Chicago 13, Ill.

Applicators Hold 6th Indiana-Ohio Conference

THE sixth annual Indiana-Ohio Aerial and Ground Applicator's conference was held at Purdue university, Lafayette, Ind., from Feb. 27 to March 1. The conference, which was attended by more than 70 of the key men in the field from the two states, discussed fertilizers, insecticides, and herbicides for both aerial and ground application.

Addressing the general session, under the chairmanship of J. V. Osmun of Purdue, Dr. Roy W. Rings, Ohio Agricultural Experiment Station, hailed the establishment of a number of Poison Information Centers as an aid in diagnosis and clinical treatment of accidental pesticide poisonings. These centers include vast files of information on the signs, symptons, specific antidotes, and other treatments for poison cases, according to Dr. Rings.

The increasing usage of endrin for mouse control in orchards, Dr. Rings warned, is one of the most serious hazards at present. Because of the concentrations of endrin employed as a rodenticide and its high order of mammalian toxicity, he said, every precaution including respirators and protective clothing should be observed in its use.

C. R. Neiswander of the Ohio Agricultural Experiment Station talked on chemical residues and the Miller Bill. The main function of the Miller Bill, Mr. Neiswander said, is to establish the confidence of the American public in the safety of pest control practices. To maintain this confidence, he continued, it is important that growers follow strictly the instructions issued for the control of pests.

Although the Miller Bill applies only to products in interstate commerce, Mr. Neiswander said that the same instructions should be followed for products consumed locally. "If foods are not safe when shipped across state lines," he explained, "they certainly should not be considered safe in Ohio and Indiana."

R. C. Clark of Eli Lilly & Co., Indianapolis gave a talk on public relations in which he presented case reports to demonstrate the practical use of public relations. Mr. Clark also listed organizations and individuals who might be useful in spreading the sales message to prospective customers.

Speaking on the principles of crop fertilization, S. A. Barber of Purdue told the conferees that experiments which have been conducted by the agronomy department of Purdue over the past five years indicate that the major portion of fertilizer may be applied broadcast once every three or four years and only a small amount of fertilizer need be applied in the rows. He said that this practice is economical when large amounts of fertilizer are used and where fertilization is conducted according to the need as determined by soil tests.

"Complete liquid fertilizers are being used more and more on Indiana farms," according to A. J. Ohlrogge of Purdue, who said that about two per cent of all complete mixed fertilizers are used in the liquid form. Mr. Ohlrogge said that extensive tests in Michigan had demonstrated that liquids are equal to solids when the same chemical compounds are used and when applied in a similar manner.

H. B. Petty, University of Illinois, told the conference about Fly Control and Barn Spraying. "With the occurrence of resistance to chlorinated hydrocarbons," Mr. Petty explained, "our fly control problem became severe." He said that commercial applicators are still in the barn spraying business where fly control is a must but in other areas fly control business has decreased very noticeably.

"Fly control is possible," Mr. Petty concluded, "but it is no longer a cheap operation."

The final address of the general session was presented by W. J. Buchanan of the South Cook County Mosquito Abatement District, who talked on mosquito control. In his discussion Mr. Buchanan stated that aircraft have been used in mosquito control since 1923. Since the advent of the helicopter, he said, it has become practical to treat small areas by air. Mr. Buchanan explained that helicopter applications cost 76 cents per acre, compared with $2.12 per acre with ground equipment and $3.10 per acre by hand.

Next year's conference of the Indiana-Ohio aerial and ground applicators has been tentatively scheduled for February or March at Ohio State University, Columbus.

•

100 At Pesticide School

The sixth annual pesticide chemicals school, which was held at Clemson college, Clemson, S. C., Feb. 27 and 28, was attended by more than 100 agricultural leaders and representatives of the agricultural chemical industry.

The meeting featured talks and discussions on new insect problems, new weed and disease problems, safe use of chemical pesticides, insecticide recommendations with emphasis on insect resistance to insecticides, use of chemicals to control nematodes, and weed control.

•

V-C Proposes 2-Way Freight

William H. Wilson, president of the Virginia-Carolina Chemical Corp., Richmond, Va., has asked both the Atlantic Coast Line and the Seaboard Air Line railroads to consider the transportation of coal south into Florida and phosphate on the return haul north, thus reducing freight rates substantially.

Mr. Wilson requested prompt action in telegrams to the presidents of both lines saying that V-C desires to give "serious consideration to the possibility of using water transportation if we cannot realize important economies by using the railroads."

•

Heptachlor Promotion Up

Velsicol Chemical Corp., Chicago, has instituted an expanded promotional campaign in the Midwest to push the use of heptachlor for soil insect control. Over 12,000,000 advertising messages and 50,000 direct mail messages are being used to tell the heptachlor story.

GRINDS BETTER

PESTMASTER* DDT

SAVES MONEY

IT COSTS LESS TO GRIND POWDERED PESTMASTER* DDT than any DDT in flake form. Formulators know it is a hard, clean, stable technical grade. The difference in processing cost means more profit for you. The high quality of PESTMASTER* DDT means a better product for your customers. And PESTMASTER* will add uniformity and stability to your product.

If you export or use 75% DDT Wettable Powder you'll like PESTMASTER*. You'll like its resistance to tropical conditions, the careful packaging to preserve its qualities, and most of all its uniform wettable and suspension properties. Use the coupon below for samples, prices and conditions.

Send a sample of PESTMASTER* DDT Technical Grade (100%) ☐ Prices ☐

Send a sample of PESTMASTER* 75% Wettable ☐ Prices ☐

Name.....

Street Address.....

Company or Government Agency.....

City..... State..... Country.....

MC®

D-57-1

*Reg. U.S. Pat. Off.

MICHIGAN CHEMICAL CORPORATION

541 Bankson Street Saint Louis, Michigan

EASTERN SALES OFFICE: 230 Park Avenue, New York 17, New York

QUALITY PRODUCER OF PESTMASTER* DDT AND METHYL BROMIDE AND OTHER AGRICULTURAL CHEMICALS

ACS In Miami April 7-12

Meetings of the Agricultural and Food Chemistry division at the 131st national meeting of the American Chemical Society, April 7 to 12, will be held in the Shelbourne Hotel at Miami Beach, under the chairmanship of D. M. Doty.

Among the features of the division's meetings will be a paper on chelating agents in the control of trace element deficiencies in plants. Information on the subject has been prepared by Harry Kroll, Arthur Wallace, Lee M. Shannon, J. Richard Kuykendall, and James Powers.

When the Pesticides Subdivision of the group gets together on the afternoon of April 10, D. A. Greenwood will preside over the general session. W. R. Diveley, A. H. Haubein, A. D. Lohr, and P. B. Moseley will discuss two new organophosphorus derivatives of p-Dioxane with excellent insecticidal and acaricidal activity.

"Generation of Ammonia for In-Package Fumigation" will be discussed by F. A. Gunther, R. C. Blinn, J. H. Barkley, M. J. Kolbezen, and E. A. Staggs. Edgar Selz and Paul Lindner will tell of recent developments in pesticide formulations, and Bernard E. Conley will conclude the general session with a paper entitled, "Contribution of Pesticides to Accidental Poisoning."

The 132nd meeting will be held in New York, Sept. 8 to 13.

•

Elemental Basis Discussed

A statement concerning the shift to elemental basis for expressing fertilizer grades was presented at the joint Agronomist-Industry meeting in Chicago on Feb. 14 and 15 by M. B. Russell, head of the agronomy department at the University of Illinois. The statement had been prepared by midwestern agronomists.

In his address, Mr. Russell expressed the hope that "reasonable and sincere college, industry, and control officials can immediately join hands to make the transition in an orderly and logical manner." It is generally accepted that the change is inevitable, he said, and it is just a question of "when and how."

Equipment, Supplies, Bulletins

New Kraft Bag Brochure

Kraft Bag Corp. announce a new brochure on the newest Kraftpacker model that accommodates weights from 25 to 200 pounds. Among the new features of this model are: heavier gauge steel construction; removable and adjustable filling spout; hinged bagging cone; and removable endless feeder conveyor belt.

•

Granular Allied Herbicide

A new granular chemical herbicide, which gives full season control of most annual and perennial grasses and broad leafed weeds in non-crop areas, has been developed by the General Chemical division of Allied Chemical & Dye Corp., New York. The new product is designed for dry application with simple, inexpensive equipment and is being marketed under the trade name of Urox Weed Killer.

•

New Chlordane Booklet

The Velsicol Chemical Corp., Chicago, has issued a brochure called, "Here's What Chlordane Insecticides Can Do For Your City." The contents include technical bulletins dealing with a wide variety of insect pests, insect habits, insecticide dosages, and other aspects of successful municipal insect control.

•

Lawn-Garden Kit

Robot Gardener, a new product of Leeds Chemical Products Co., Chicago, is a home-type applicator which attaches to a hose or sprinkler. The equipment is being introduced in kit form which includes two pounds of fertilizer, an insecticide and herbicide. The kit will be introduced at $4.95.

•

Stauffer Booklet on Sulfur

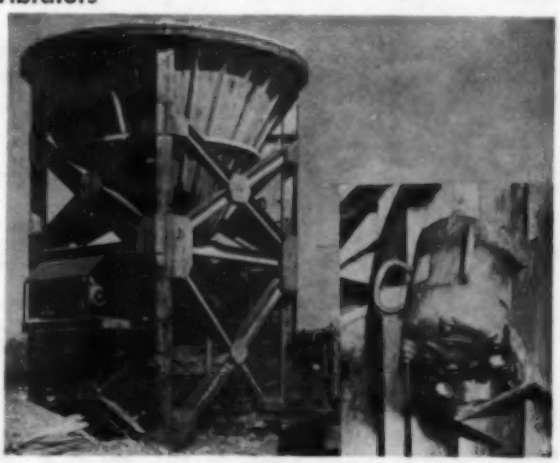
"Stauffer Sulfurs," a 50-page booklet recently issued by Stauffer Chemical Co., New York, reviews the history of sulfur, its occurrence and uses, production, refining processes, physical and chemical properties, methods of analysis, handling operations, etc.

Defining the uses of 7,000,000 tons of sulfur in the United States each year ,the booklet shows that 33% is used in the fertilizer industry alone, another 5% is used in soil sulfur, in fungicides, insecticides, and in rubber vulcanizing. Some excellent photographs illustrate the book.

Davison Uses Bin Vibrators

Davison Chemical Co., Bartow, Fla., a division of W. R. Grace & Co., New York, has installed Cleveland vibrators to keep material flowing through bins without any of the build-up which had become a serious problem.

The vibrator, Type RC-50, operates on the rotating, eccentric weight principle. One vibrator on each of two bins has proved sufficient to keep material moving in a steady flow.



Hudson Bak-Pak Duster

An engine-powered duster that can be carried on the back is offered by the H. D. Hudson Manufacturing Co., Chicago. Named the "Bak-Pak," the new duster discharges dust at high velocity.

Available with the duster is a mist blower attachment that can be used to introduce a water mist into the dust stream.

•

U.S.D.A. Medfly Booklet

A booklet describing the methods of eradicating the Mediterranean fruit fly has been issued by the U. S. Department of Agriculture. Prepared by the Plant Pest Control Branch and the Entomology Research Branch of the Agricultural Research Service, the booklet presents the history of the fly together with color illustrations of the pest.

•

Maine Herbicide Guide

The Maine Agricultural Experiment Station, University of Maine, Orono, has issued a publication in cooperation with the Maine Extension Service titled "Chemical Weed Killers."

A comprehensive guide to the selection and application of recommended herbicides for the control of weeds in garden and commercial crops, the publication, No. 628, is available from the Experiment station.

•

Home Seed Treating Kit

Panogen, Inc., Ringwood, Ill., is distributing its Panogen liquid seed disinfectant in small, handy sizes for home treating. A dispenser, designed for easy use with the bottles, delivers the correct amount of disinfectants to the seed being treated.

•

Automatic Bag Filler

Fully automatic packaging has been extended to the filling of open mouth multiwall bags with the development by St. Regis Paper Co., New York, of its St. Regis VredO-Matic packer which makes it possible to fill open mouth multiwalls and sew them closed with or without bound-over tape automatically. The VredO-Matic packer is used in combination with a St. Regis pre-weighing scale.

The new packer is completely automatic. The bag is moved under the filling spout and through the sewing machine automatically.

•

C.I.C. Adds Sticking Agent

Chemical Insecticide Corp., Brooklyn, has developed a new sticking agent, U-101, which it is adding to the liquid fungicide it markets under the Chem-Bam name. U-101 is said to give crops an impregnable coating of fungicide that can't be washed off by rain or watering.

Safety Topics in Booklet

A 32-page booklet containing the full reports given at the 44th National Safety Congress held in Chicago, October, 1956, is being distributed by the National Safety Council, 425 N. Michigan Ave., Chicago.

•

Spray Plan for Endrex

A spray program for orchards is offered foreign growers by Shell Chemical Co., Ltd., London. The leaflet details a program using "Endrix," metasystox, arsenate, DDT, etc.

VANDERBILT DILUENTS

save money – make money

LOWER STORAGE COSTS — FLATTENED BAGS SAVE SPACE

With Vanderbilt flattened bags, you store almost one-third more clay in the same space. The illustration shows Continental Clay but similar savings are possible with Pyrax ABB (pyrophyllite). You save on rent — cut down handling labor moving clays in and out of storage.

LOWER HANDLING COSTS — UNITIZED SHIPMENTS

It takes less time and fewer man-hours to unload and handle Vanderbilt unitized diluents. Units of about 3000 pounds are stacked on throw away fiberboard sheet. A special adhesive provides secure traveling but easy removal at time of use.

MORE SALES — NO DELAYS — RAPID SHIPMENT

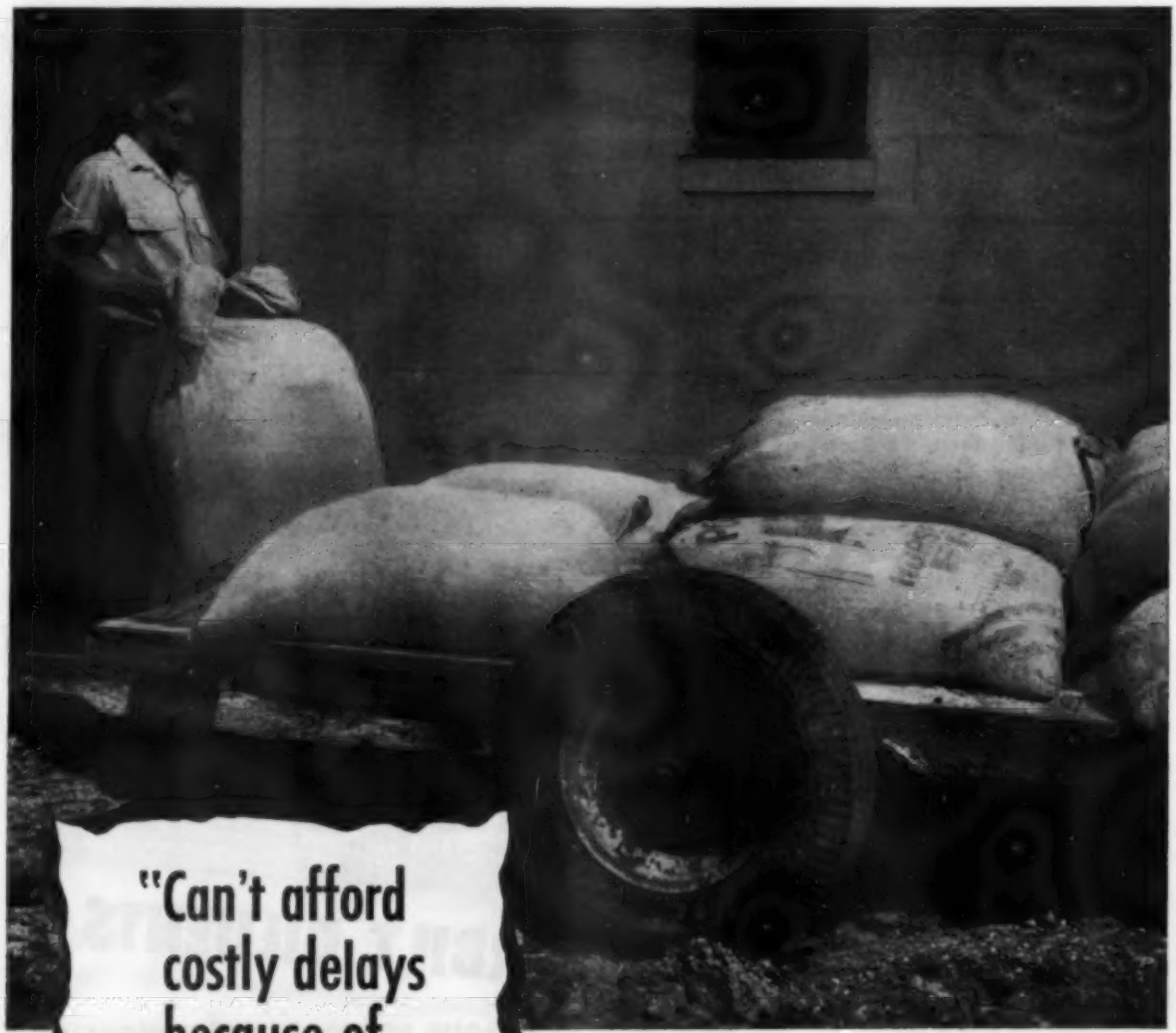
Vanderbilt plants (Pyrax ABB from Robbins, N.C., and Continental Clay from Bath, S.C.) have the capacity to deliver without delay, even during the height of the season. Modern processing equipment assures prompt shipment on all orders. What's more, you can count on the same, uniform, high-quality diluents from shipment to shipment, season to season. There's no need to constantly adjust formulas — mixing is easier and quicker — dusts and sprays always have the same, full effectiveness.

Phone in a test order today — see for yourself how Vanderbilt clays save you time, money and worry.

free samples and Bulletin 23D on request.

R. T. VANDERBILT CO.
SPECIALTIES DEPARTMENT
230 PARK AVE., NEW YORK 17, N. Y.

PHONE ORDERS
MUrray Hill 6-6864
New York



"Can't afford costly delays because of torn bags,"

says Harlan Jackson, Montgomery, Alabama farmer. "We buy fertilizer in burlap bags because we can handle them as roughly as we want. Then too, the re-use and resale value of the bags are big reasons for burlap. We make a nice cash saving from bag returns over the year, and we keep some empties for countless uses around the farm."

The resale value of the burlap bag gives your customer a cash discount on every ton of fertilizer he buys.

Just ask your own customers—

they'll tell you that burlap

Is strong — takes dragging, dropping, *man-handling* — any tough job on the farm.

Gives good ventilation — keeps farm supplies and products fresh.

Laughs at sudden showers — wetness or dampness can't weaken it.

Saves money — extra value from re-sale and re-use.

Saves storage space — stacks to any height without slipping.

Has 1000 uses — always in demand on the farm (popular with farm wives, too!)

THE BURLAP COUNCIL

of the Indian Jute Mills Association

155 East 44th Street, New York 17, N. Y.

BREVITIES

FRONTIER CHEMICAL CO., Wichita, Kans., has acquired a controlling interest in Rare Earths Chemical Co., Inc., of Mead, Colo., a processor of rare earth ores producing rare earth oxides.

AC

EDWARD F. ARENZ has been elected to the new position of vice-president—trade shows of the Garden Supply Merchandiser, Inc., Baltimore, Md., Mr. Arenz was formerly secretary-treasurer and director of trade shows.

AC

NITROGEN DIVISION, Allied Chemical & Dye Corp., New York, has increased the price of all solid urea products for agriculture. Price has ben increased $5 per net ton product.

AC

HAYES-SAMMONS CHEMICAL CO., Mission, Tex., will build an agricultural chemical formulating plant and sales office in Indianola, Miss.

AC

SARGEANT CALCIUM CO., Des Moines, Iowa, has completed construction of a $25,000 limestone plant at Alden, Iowa. The new firm will produce calcium for livestock and poultry manufacturers and mixers, and soil vitalizer.

AC

JAMES G. GIBBS has been elected president of the Etiwan Fertilizer Co., Charleston, S. C., succeeding the late W. R. Sullivan of Atlanta, Ga., who died in August.

AC

A FIRE AND EXPLOSION in the fertilizer warehouse of Allied Chemical's Nitrogen division at South Point, Ohio, started in a 12-12-12 storage bin and damaged approximately 40,000 tons of fertilizer last month. The plant was not damaged, but was shut down until mid-March due to damage to bagging equipment. It is now operating.

CLARK EQUIPMENT CO., Battle Creek, Mich., has named new dealers in Dayton, Ohio, and Miami, Fla., to sell and service the fork-lift trucks, straddle carriers, and powered hand trucks produced by the Industrial Truck division.

AC

Dues and Dueber, Inc., Dayton, will handle sales in Ohio, and W. E. Johnson Equipment Co., Miami, handles sales in South Florida.

AC

DICKSON S. LANG has joined the agricultural chemicals department of the Consumers Cooperative Association, Kans. Mr. Lang, an entomologist, previously worked for the Kansas Entomological Commission.

AC

TVA's impending sale at public auction of a 148-acre industrial plant site six miles north of Mobile, Ala., will bring to approximately $13,000,000 the sum realized from sale of land surplus to the agency's program needs.

AC

THE PHELPS DODGE CORP., New York, has announced the election of Percy L. Douglas as a director. Mr. Douglas is the executive vice president of the Otis Elevator Co.

AC

J. C. FINDLAN has been advanced to the position of sales manager of the Geigy Industrial Chemical Division of Geigy Chemical Corp., Ardsley, N. Y.

AC

CHARLES M. HUTCHINSON has been named vice-president of Panogen, Inc., Ringwood, Ill.

AC

SINCLAIR CHEMICALS, Inc., New York, has announced the appointment of Earl Noblet as assistant manager of market development. Mr. Noblet had previously been engaged in market research activities.

"Blue Chip" NITROFORM® Found Ideal For Fertilizer Mixes

Rhode Island University Presents a Study on Urea-Form Fertilizer Compositions

On February 2nd, 1957 before a group of New England agronomists, Rhode Island University presented data which resolved one of the most controversial subjects since urea-forms were commercially introduced to the market a few years ago. Nitroform has always suggested the use of their urea-form in fertilizer formulas if the user were to obtain the highest benefit from his U-F applications. The benefits of single season applications would be greatly reduced if the potential user were forced to make applications of phosphate and potash following the nitrogen. Again it has been shown that various sources of nitrogen greatly improved the working qualities and nitrification characteristics of urea-form. Work conducted at Rhode Island University under the direction of Dr. Jesse DeFrance proves conclusively that urea-forms are both practical and desirable in fertilizer formulas.

Write today for full information and facts and figures for manufacturers.

NITROFORM AGRICULTURAL CHEMICALS, INC.

A DIVISION OF Woonsocket Color & Chemical Co. Woonsocket, R. I.

Fill out and mail coupon today!

Nitroform Agricultural Chemicals, Inc.
Dept. E, 92 Sunnyside Avenue
Woonsocket, R. I.

Please send me all the facts about Nitroform.

Name _____

Address _____

City _____ State _____

new source of high quality lime ...quicklime and hydrate

West End, supplier of quality chemicals for over 31 years, proudly announces expansion of its hydrate and quicklime production. Discovery of an extensive deposit of high grade limerock resulted in the construction of a large new processing plant. The photo shown here is of the giant 340 foot rotary kiln. The plant will soon be producing increased quantities of highest quality lime to serve the needs of growing western industry. We suggest you give consideration to West End as a primary source of supply. Inquiries and your specifications are invited.

WEST END

West End Chemical Company

DIVISION OF STAUFFER CHEMICAL COMPANY

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIF. · PLANT, WESTEND, CALIF.

SODA ASH • BORAX • SODIUM SULFATE • SALT CAKE • HYDRATED LIME

LEEDS CHEMICAL PRODUCTS CO., Chicago, announced that H. R. Sugraman was elected president.

AC

named sales manager, East Central area, for the Northeastern district of the Plant Food division of Olin Mathieson Chemical Corp., New York. His headquarters are in Columbus, Ohio.

AC

MAGIC LITE CO., Inc., Bastrop, La., has been granted a charter of incorporation to manufacture and sell insecticides.

AC

THE WEST KENTUCKY LIQUID FERTILIZER CO., INC., Hopkinsville, Ky., is nearing completion on the construction of a liquid fertilizer plant which will produce complete fertilizer formulas.

AC

R. H. AYERS has been named sales manager of the Paper Bag division of the Chase Bag Co., New York.

TRADE LISTINGS

(*From page 22*)

Carolinas-Virginia Formulators Association, 516 S. Salisbury St., Raleigh, N. C. J. B. Maddrey, executive secretary.

California Fertilizer Association, Sidney Bierly, executive secretary, Suite 1, Boothe Building, 475 Huntington Drive, San Marino, California.

Chemical Specialty Manufacturers' Association, 110 East 42nd St., New York City, Dr. H. W. Hamilton, secretary.

Entomological Society of America, 1530 P. Street N. W., Washington, D. C., R. H. Nelson, secretary.

Mid-West Soil Improvement Committee, 121 West Wacker Drive, Chicago 1, Ill. Z. H. Beers, executive-secretary.

National Nitrogen Solutions Association, 2217 Tribune Tower, Chicago, Ill. M. F. Collie, secretary.

National Cotton Council, PO Box 9905, Memphis, Tenn.

Weed Society of America, W. C. Shaw, secretary, Field Crops Research Branch, Beltsville, Md.

Western Agricultural Chemicals Association, Charles Barnard, executive secretary, 2465 Kenwood Ave., San Jose, Calif.

DR. ARTHUR M. SMITH, assistant to the vice president, has been made responsible for the direction of the anhydrous ammonia program of the Plant Food Division, Olin Mathieson Chemical Corp., New York. His headquarters are in Little Rock, Ark.

AC

HOMER DUDLEY has been named sales supervisor for direct application materials in the Omaha district by the Nitrogen division of the Allied Chemical & Dye Corp., New York.

FERTILIZER INGREDIENTS

(*From page 71*)

ever the units may be, it is then necessary to determine, from the characteristic of the integrator, how many electrical pulses this represents. The predetermining counter is then set manually to a number on its face which corresponds to the number of electrical pulses that are to be expected from the flow integrator. It is a characteristic of the predetermining counter, that while it is receiving electrical pulses from the integrator it does nothing except count them until it reaches the number which corresponds to the predetermined amount that has been chosen as the required number of pulses for this particular batch.

Having received the correct number of pulses, the predetermining counter then operates a solenoid valve which may be used either directly to shut off the flow stream or may be used to operate a diaphragm motor valve, which in turn will shut off the flow stream. The important thing to note is that there has been a predetermined amount of the fluid passed through the pipe line before the valve shuts off the flow. An arrangement like this can be used for each ingredient required for the particular batch. This means that if we are mixing anhydrous ammonia, potash, sulfuric acid and water, there might be four separate systems, one for each of the fluids involved, and they could all be dumped simultaneously into the mixing container, or they might be

CHEMICALS
FOR AGRICULTURE

COPPER SULPHATE
Crystals Powdered
Basic Copper Sulphate

ZEE-N-O
Neutral Zinc 56% Zinc as metallic
The Highest Test Nutritional Zinc

MANGANO
Neutral Manganese 55% Manganese as metallic

W. R. E. ANDREWS SALES, INC.
1505 Race Street, Philadelphia 2, Pa.
Since 1926
Agricultural Chemical Specialties

dumped into it in a certain sequence, but regardless when all of these streams have been shut off we will have in the container a known amount of each of the materials, thus providing a controlled batch. This system has certain advantages over manual control, first, it provides precise proportioning of the ingredients, because measuring and counting are done automatically; second, it operates unattended after the push button is first used to start it, thus there is no need for a man to monitor the flowing streams, or to determine when sufficient fluid has been added; thirdly, any variation in flow rate within the pipe line does not affect the amount of the batch, since the integrator determines total quantity and does not concern itself with instantaneous flow rates.

The batch control system also has some disadvantages; one, it requires a man or some specific action to start the process; two, it requires mixing containers and storage capacities, since only a portion of the output is mixed at any one time; three, it sometimes takes considerable time to empty and refill the mixing containers.

These disadvantages can be overcome by going to a further refinement of the control system. It is completely possible to mix fluid streams in predetermined proportions on a continuous basis by using a device known as a ratio controller. Figure 2 shows a schematic diagram of a continuous ratio control system involving two fluid streams, one of which is controlled so that its flow rate remains a fixed ratio of the other. One stream is shown as a "controlled line" while the other, whose flow rate is not under control is known as the "wild line." The system operates as follows.

Again, we have a flow meter with a pneumatic signal output as described previously. In this case, the flow meter is measuring the rate of flow of a fluid through a particular line, and there is no need to control this flow in any special fashion except to be certain that it remains within range of the measuring device. The pneumatic signal from the flow meter this time goes to a ratio controller where it becomes one of the input signals. In this case, it is the wild signal, since it is not under control.

At the same time we have a second fluid stream whose flow rate is also being measured by a second flow meter. In the same manner a pneumatic signal is sent from this flow meter to the ratio controller. Here we are going to control the flow rate of the fluid, and hence this line is known as the controlled line. The ratio controller has had set into it manually a value which represents the desired proportion of these two fluids. For example, if it is desired to maintain the fluid in the controlled line at a flow rate which is one half that of the fluid in the wild line, the ratio controller would be set for 50%, or if it is desired to have the flow in the controlled line twice what it is in the wild line the ratio controller would be set for 200%.

This controller operates by comparing the ratio of the signals as received to the ratio as set into it by the operator. If the controlled line is not up to the required ratio, it will operate to change the setting of a valve in the controlled line to increase the flow rate. If the flow rate in the controlled line is too high, it will operate the valve in such a manner as to reduce the flow rate to the required proportion.

This system can even be used when handling dry material, and figure 3 shows such an arrangement with the dry material being the wild line. As can be seen, the dry material is handled through a hopper arrangement and out on to a conveyor belt which has a weighing arrangement supporting one end. This weighing arrangement incorporates a pneumatic transmitter, which provides a pneumatic signal proportional to the weight of the material on the belt. Since the belt is running and dumping off the material which is on it, it follows that the weight of the belt as measured by the pneumatic device, with proper zeroing and adjustments becomes proportional to the rate of feed of the dry materials.

This rate of feed can now be made the wild signal to one or more ratio controllers which will operate to maintain the flow rate of a liquid stream at a fixed proportion to the weight of the dry material being handled. A good application of this type of system occurs in the process of recycling fines. Here, of course, you have a typically wild situation, the amount of fines goes up and down during the course of a day and even from minute to minute. With this system you can effectively measure the rate at which fines are being recycled, and can control the addition of liquid materials so that maximum production can be achieved without causing a too dry mixture to provide a high percentage of fines, while at the same time preventing the mixture from getting too wet and thereby producing an unsatisfactory product.

In common with all other industries the fertilizer industry, and each particular fertilizer manufacturing plant, must progress or it will die. I have attempted to show you in a few brief moments today a possible avenue of progress. Costs must be reduced and quality must be increased. These two requirements appear on the surface to be incompatible, but yet the manufacturer who achieves both of them and achieves them on a continuing basis will grow and prosper while his competitor who does not do these things will decline and disappear. I have shown you that instrumentation can help you to achieve this result.★★

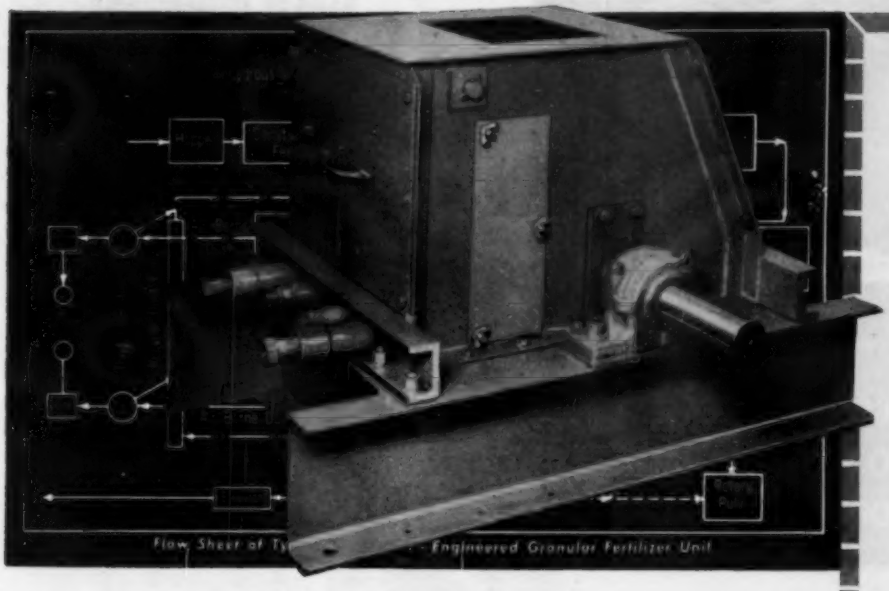
NITROGEN CHARACTERISTICS

(*From Page 69*)

nitrate is held constant. Spensol A contains 12.8 per cent water and Spensol A-6 contains 6 per cent water with the same ratio of free ammonia to ammonium-nitrate.

The other way is to use hot recycle; provided that the hot recycle is also lower in moisture. Plants so equipped to return material exit the dryer directly to the ammoniator will need to start-up by putting material into the system and circulating it until it is hot and dry before raw material feed is begun. When this is done properly, the temperature in the ammoniator and dryer can be increased 30° to 40° degrees, which results in a

This Rotary Pulverizer Belongs In Your Fertilizer Unit, Too!



IT'S STURTEVANT-ENGINEERED TO GRIND UP TO 35 TONS OF TAILINGS PER HOUR

Mixing plant operators agree! They'll tell you that a Sturtevant Rotary Pulverizer beats anything else for keeping a granular or powdered fertilizer unit speeding along at full capacity. It's far better than Hammer Mills with hammers that stick . . . Cage Mills that skip small pellets . . . Knives that only slice and shear. No overload stoppages nor clogged grates. So, daily accumulation of over-sized lumps is no longer a problem. And, to top it off, original Sturtevant "Open-Door" accessibility makes cleaning quick and easy.

Sturtevant Engineering can also help you in other ways. For more than 75 years, leaders in the fertilizer industry have depended on us for assistance in designing their units and in keeping them up-to-date. Since we custom-build mixers, batching units, granulators, hopper and conveying systems to fit agreed-upon specifications, you can be sure of getting a complete unit or individual components that fit your requirements like a glove. Why be satisfied with anything less?

Investigate now! Filling out the convenient coupon at the right is the first step toward better fertilizer at lower cost. Why not mail it today?

STURTEVANT

Dry Processing Equipment

The "OPEN-DOOR" to *lower* operating costs over *more* years

CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
BLENDERS • GRANULATORS • CONVEYORS • ELEVATORS

I am interested in a new unit ☐ conversion ☐

Desired capacity is _____

Name _____ Title _____

Firm _____

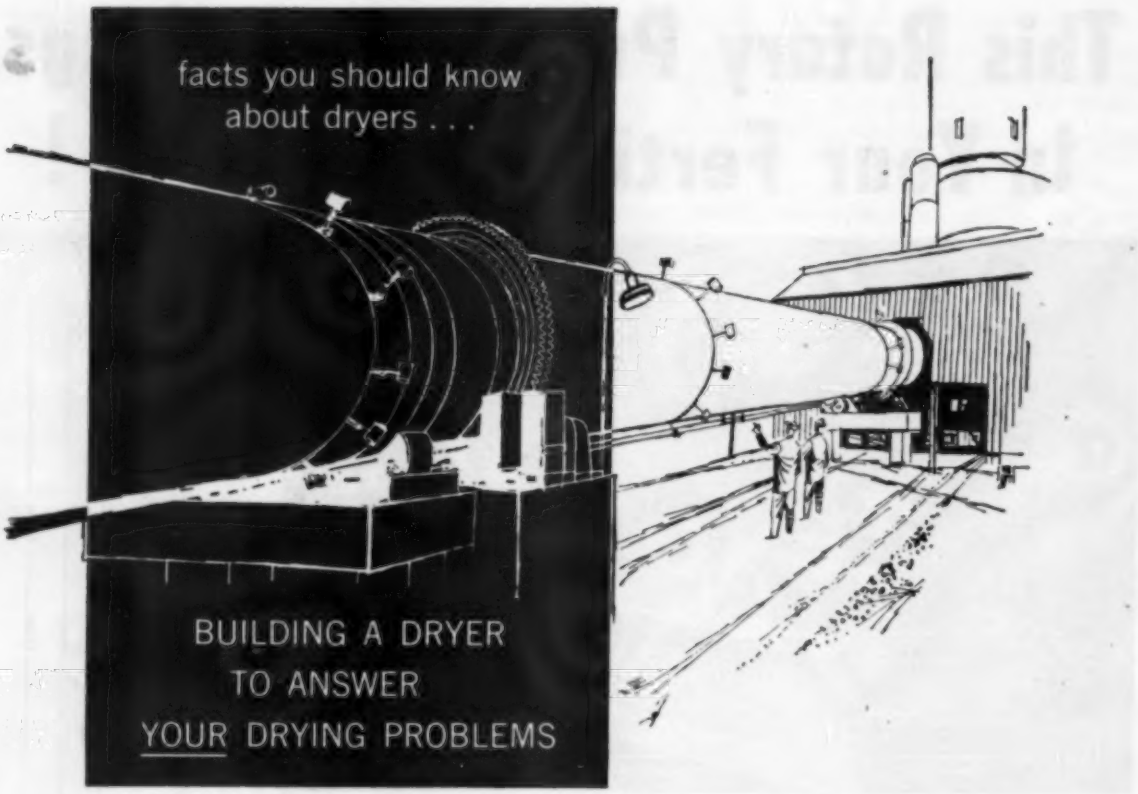
Street _____

City _____ Zone _____ State _____

STURTEVANT MILL COMPANY, 123 Clayton Street, Boston 22, Mass.

Please send me bulletin on Rotary Pulverizers ☐
Also bulletins on Sturtevant machines for:

☐ CRUSHING ☐ GRINDING ☐ GRANULATORS
☐ MICRON-GRINDING ☐ SEPARATING ☐ MIXING
☐ SCREENING ☐ FEEDING
☐ MECHANICAL DEN & EXCAVATORS ☐ ELEVATING & CONVEYING



For over 55 years, Louisville Dryers have been solving industry's drying problems and effecting marked economies. The following is intended as an introduction to selecting the right type of dryer.

Q. *Since my required production capacity indicates a continuous dryer will give lowest drying cost, which design is best for my purpose?*

A. Assuming the material is in bulk form, a rotary type dryer is best for your purpose. It is almost axiomatic that materials suited to drying in rotary dryers are dried at lowest *overall* cost in that type.

Q. *If I consider a rotary dryer, should it use high temperature furnace gases or low temperature warm air to dry my material?*

A. This will depend on your particular material, for instance—

1. The temperature to which it can be heated without injury.
2. The amount of moisture in the wet material.
3. The material temperature necessary to dry the material to the desired final moisture content.
4. Whether or not the material will be contaminated by contact with combustion gases.

Q. *I think my material will not be injured by gases from an oil furnace. Should I use a parallel or counter current rotary dryer?*

A. This will depend on a number of considerations, such as:—

1. Is the material flammable?
2. How dry must the product be?
3. Is the dried product dusty or is it granular with very small percentage of "fines?"
4. Will "case hardening" occur in high temperature atmosphere inhibiting uniform and complete drying of large lumps and particles?

Q. *There seems to be quite a number of conditions affecting the selection of the proper dryer type.*

A. Very true. And the conditions involved are not all included in the above discussion by any means.

Q. *How can I be sure of making the proper choice?*

A. An experienced drying engineer knows how to evaluate the various conditions involved in each drying problem and will make a sensible recommendation. If advisable he will also recommend pilot plant tests to confirm his conclusions.

Q. *How can I obtain such advice?*

A. Submit your problem to General American. An analysis and recommendation by a LOUISVILLE engineer entails no obligation on your part.

GENERAL AMERICAN TRADE MARK

LOUISVILLE DRYING MACHINERY UNIT

GENERAL AMERICAN TRANSPORTATION CORPORATION

Dryer General Sales Office: 139 So. Fourth Street, Louisville 2, Kentucky
Eastern Sales Office: 380 Madison Avenue, New York 17, New York
In Canada: Canadian Locomotive Company, Ltd., Kingston, Ontario, Canada
General Offices: 135 S. La Salle Street, Chicago 90, Illinois

much lower finished product moisture and better mechanical condition.

A continuing study on this approach is being made and supporting data on pilot plant and commercial scale production will be developed.★★

COMBINATION SPRAYS

(*Continued from Page 34*)

protective value offered by the combination sprays usually more than counter-balance the value of the reduced back action.

It is this writer's belief that fungicide combinations are desirable to control a larger number of diseases by a given application and to improve control by imparting to, or improving, the protective or eradicant properties of an application.

Fungicide and Non-Fungicide Combinations

THUS far we have considered only combinations of fungicides. Yet in commercial use any given fungicide will be used in combination with various fillers, solvents, insecticides, and conditioning agents. Although this phase deserves considerable space, only brief mention can be made of it here.

Fillers are normally considered to be inert and serve only to improve certain physical properties or to reduce the concentration of the fungicide mixture, particularly when the fungicide is to be applied as a dust. Even though so considered, the fillers are frequently not inert but may influence materially the fungitoxic or phytotoxic properties of the mixture. An excellent example of the first is the inactivation of streptomycin by certain clays through absorption.

A good example of an effect of fillers on phytotoxicity is that supplied by captan + Kaolonite, or captan + talc, when applied to Bountiful bush bean leaves. Where captan and filler are placed as drops on the under surface of the leaves a captan kaolonite mixture will be found to be much more injurious than a captan-talc formulation. Our own injury (average) ratings of these two mixtures in many such tests is captan-kaolonite 52.0, captan-talc 16.3. Chloride determinations on the above two mixtures indicate that captan breakdown in each mixture proceeds at about the same rate where they are held in a water suspension. In the dried residue, however, the decomposition of the fungicide proceeds at a much faster rate with the kaolonite filler. In addition, talc, due to its greater base exchange capacity and innate alkalinity, suppresses a pH change in the mixture where kaolinite does not.

Antibiotics

DURING the brief period that antibiotics have been used in disease control experiments, a most exciting and encouraging chapter has been recorded. Now for the first time many diseases are being satisfactorily controlled that heretofore were uncontrollable. Prominent among these are bacterial diseases where ingress occurs through the stomata of which bacterial spot of stone fruits caused by *Xanthomonas pruni* is a good example. This disease has gone uncontrolled for many years and despite our best efforts the entire crops of susceptible varieties of peaches have occasionally been rendered worthless and the trees weakened by defoliation. The best control achieved before antibiotics became available was about 50 per cent reduction in fruit and less for leaf infection. Perhaps an understanding of the means of ingress will make clear the reasons for our repeated failures in achieving control over the years.

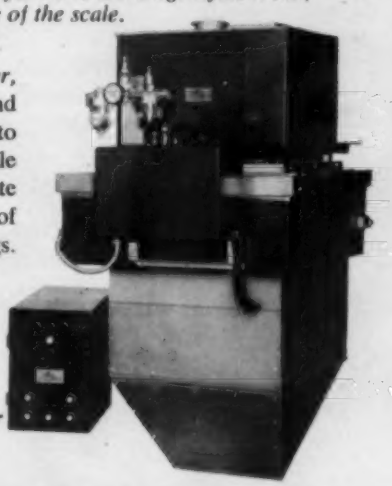
In understanding control of such diseases, it is necessary first to understand that ingress does not result from a growth process, as is the case with fungus diseases. The bacteria do not grow into the leaf but swim in or are carried in through the stoma in water currents. The writer has produced bacterial spot infections to peach foliage repeatedly by submerging warm peach leaves in cold water containing the bacterial pathogen. The cold water chills the leaf which, by cooling the air present in the in-

Automatic weighing of FLOODING MATERIALS

Only Thayer Scales have the Thayer Plate Leverage System that is guaranteed accurate for the life of the scale.

Flooding powders, *and even water,* can be positively controlled and accurately batched or filled into containers with this Thayer Scale Autoweightion System. Remote controls permit quick changes of materials and weight settings. Amazing accuracy is retained regardless of shocks or surrounding dust conditions. Please write for engineering data.

MODEL B-36R *Models available for batches from 5 to 5,000 lbs.*



THE Thayer SCALE

BATCHING • FILLING • CHECKING — AUTOMATICALLY BY WEIGHT

AUTOWEIGHTION

THE THAYER SCALE CORP., 4 Thayer Park, Pembroke, Mass.

Introducing...Fulton's Ful-Flex Elastic Multiwall Bags

Do the bags you now use have all these 6 advantages?

STRONG... Tough plies of crinkled paper resist tearing.

HANDLES EASY... Ready-to-grip surface means speedier loading.

PLIABLE... Flexibility of bags makes them easy to work with.

SHOCKPROOF... Elastic action reduces breakage from dropping.

DAMP-PROOF... Moisture barrier sheet (if specified) protects products.

SKIDPROOF... Crinkled surface provides grip in stacking bags.

Protect costly chemicals with this tough new package

FOR ALL YOUR BAG NEEDS — LOOK TO FULTON FIRST!

Fulton
BAG & COTTON MILLS

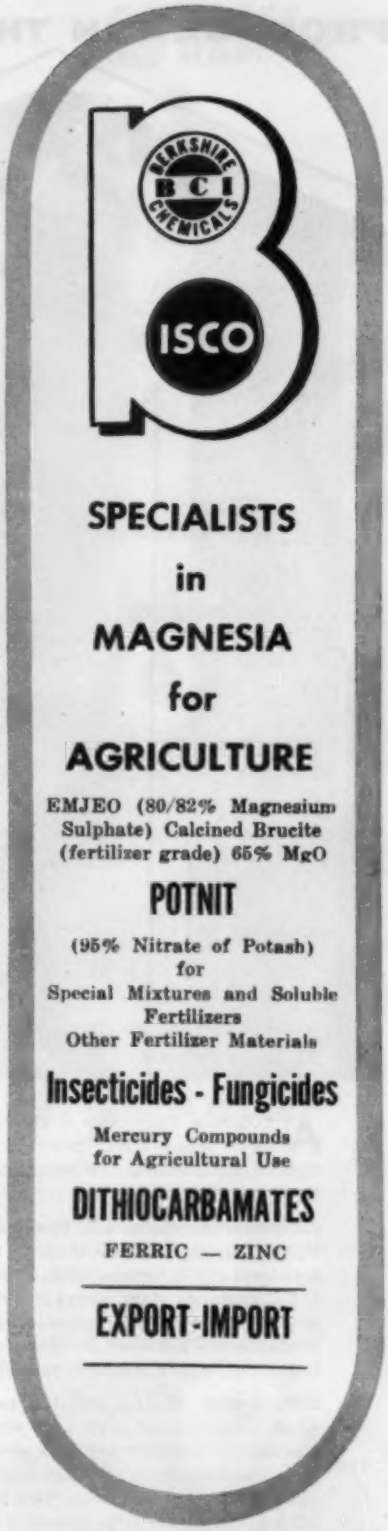
ATLANTA • CHICAGO • DALLAS • DENVER • KANSAS CITY
LOS ANGELES • MINNEAPOLIS • NEW ORLEANS • NEW YORK
OKLAHOMA CITY • PHOENIX • ST. LOUIS • SAN FRANCISCO
SAVANNAH

tercellular spaces, produces a negative pressure in the leaf and thus facilitates the inward movement of water. In a similar manner, cold rains accompanied by winds will force water into the stomatal chambers through the stoma. If the pathogenic bacteria are in the water films, they too may swim or be drawn into the stomatal chamber. This may occur in minutes or even in seconds time; thus good bactericides, deposited on the leaf surface, have little opportunity to exert a killing action. Since the control provided by the antibiotics may occur (Table 6) not only at the leaf surface but after ingress has occurred (systemic), increased control of such diseases as bacterial spot of peach now seems possible. Although the cost of the captan-streptomycin-glycerol combination as used will prevent its commercial adoption, it does indicate that control can be achieved by a bactericide that is absorbed and exerts systemic action.

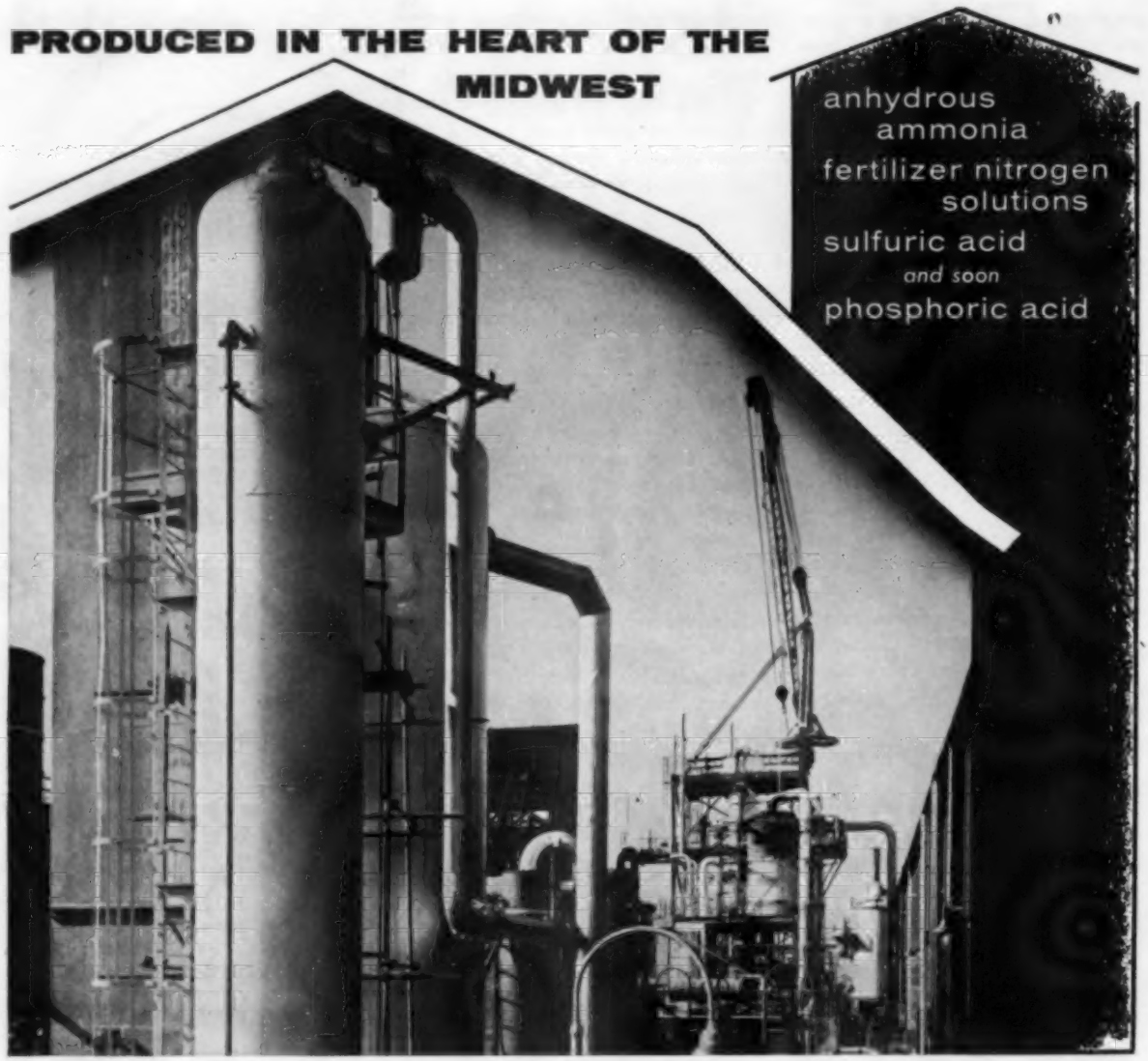
The protection offered by antibiotics in the control of fire blight has been in many instances most encouraging. In areas where this protection is being taken advantage of the crop value justifies the cost, but in many areas cost is still prohibitive. In an effort to reduce such cost, the writer, in cooperation with Dr. Szkolnik of the New York Agricultural Experiment station, has dusted honey bees with streptomycin by the use of a simple trap attached to the entrance of the hive. In greenhouse experiments, this method of preventing the honeybee from disseminating the viable bacteria to pear blossoms has been encouraging. The trap has not as yet been effective in preventing dissemination of the bacteria into apple blossoms. Perhaps the difference in response between the two species is due to the position of the stamens in the respective flowers. In a pear blossom the stamens are widely spaced, allowing easy access to the nectar cup. In the apple blossom, they form a tight fence-like barrier around the nectar cup. Since, in the case of the apple blossom, the bee may rub his entire body against the stamens in forcing entrance to the nectar, the need for a complete dusting of its body seems to be indicated.

Not only have the antibiotics in experiments given good control of many bacterial diseases, but several fungus diseases as well have been controlled by them. The effectiveness of actidione against cherry leaf spot is well known. Recently Zaumeyer (14) has reported protection against powdery mildew of beans (*Erysiphe polygoni*) by the use of anisomycin or griseofulvin-containing sprays. Zaumeyer and Webster reported (15) that anisomycin protects beans against rust (*Uromyces phaseoli typica*) and lima beans from downy mildew (*Phytophthora phaseoli*) attack. They also reported that griseofulvin protected beans against rust. Davis and Rothrock (3) showed that griseofulvin protected tomatoes against early blight (*Alternaria solani*) while Brian (1,2,12) showed that this antibiotic, when added to the nutrient solution, protected barley against powdery mildew (*Erysiphe graminis*), lettuce against gray mold (*Botrytis cinerea*), and tomato against early blight. Groves (7) has reported anisomycin to be effective against powdery mildew of apples (Table 3). In September of this year Zaumeyer and Webster reported that Streptomycin in various formulations effectively controlled bean downy mildew caused by *Phytophthora phaseoli*. They also reported that combinations of Copper A and Streptomycin in reduced concentrations gave considerably better protection against this disease than did either when used alone. They report, "the action in the control of downy mildew was synergistic."

Recent experiments have demonstrated the possible usefulness of antibiotics to protect harvested crops against post-harvest decay. In such experiments, DiMarco and Davis (4,5) showed that Mycostatin applied as a post-harvest dip provides good protection to peaches against brown rot and Rhizopus rot. This same antibiotic provided protection to harvested strawberries against Rhizopus and Botrytis rots.



PRODUCED IN THE HEART OF THE MIDWEST



AT TUSCOLA, ILLINOIS – in the heart of the midwest farm area – U.S.I. produces a combination of agricultural chemical raw materials for fertilizer manufacturers.

Anhydrous Ammonia and Fertilizer Nitrogen Solutions From other U.S.I. affiliated plants at Tuscola, and from a natural gas reforming unit, hydrogen flows into the U.S.I. ammonia plant, where it is reacted with nitrogen to produce anhydrous ammonia and nitrogen solutions. Since the raw materials for this operation are produced internally, supply is steady, reliable and ample.

Sulfuric Acid U.S.I.'s 400 ton per day sulfuric acid plant produces all grades of virgin acids, including electrolytic and oleum, plus a good quality of process-spent acid suited to fertilizer manufacture. This plant operates year round, permitting U.S.I. to store during off-seasons for the large in-season agricultural demand. Other sulfuric acid plants are located at Dubuque, Iowa, and Sunflower, Kansas.

And Coming Soon – Phosphoric Acid U.S.I. is building a new plant at Tuscola to produce wet process phosphoric acid. Design capacity is 30,000 tons of P_2O_5 shipped as 75% phosphoric acid.

Phosphoric Acid U.S.I.'s new plant at Tuscola produces wet process phosphoric acid from phosphate rock and U.S.I.'s sulfuric acid. Design capacity is 30,000 tons of P_2O_5 shipped as 75% phosphoric acid.

In the midst of the midwest farm area – where fertilizer demand is high and moving steadily higher – U.S.I. provides a single source for a variety of fertilizer raw materials. This source is a flexible one, since it is part of the company's chemical producing center at Tuscola. Other materials can be made for long-range demands.

For further information, address your nearest U.S.I. office, or contact Chemical Sales, U.S. Industrial Chemicals Co., 99 Park Avenue, New York 16, N. Y.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

TABLE 6
Bacterial Spot Control Studies
New Jersey—1955-56

Treatment used	Fruits Infected Constitution 1955	Fruits Infected Sunhigh 1956	Streptomycin content of leaves 1956 Young	Streptomycin content of leaves 1956 Old
	%	%	ppm	ppm
1. Wettable sulfur, check	24.8	25.0	0.0	1.2
2. Zinc sulfate, lime	11.1	12.7		
3. Captan 2#	20.0	22.7		
3. Captan 3#	15.3	18.9		
5. Captan 4#	9.6	15.2		
6. Captan 2#, Strep. 150 ppm	7.5	9.1	4.2	9.7
7. Captan 2#, Strep. 150 ppm W.A.		9.0	4.3	7.8
8. Captan 2#, Strep. 150 ppm, Glycerol		5.6	6.0	15.1

Although progress made in the control of plant diseases through the use of foliage sprays has been tremendous, an estimated three billion dollars (6) in agricultural products are destroyed each year by fungi and bacteria. The need for improved disease control measures is great and the rewards for success in this field justify our best efforts. From this winter's point of view, the future in disease control work is bright indeed and the further progress that is so badly needed will be speeded by genuine cooperation between not only scientists in several fields but between industry, state, and federal personnel.★★

LITERATURE CITED

1. Brian, P. W. *1952* "Antibiotics as systemic fungicides and bactericides" *Ann. Appl. Biol.* 39: 434-438.
2. ———, Wright, J. M., J. Stubbs and A. M. Way *1951* "Uptake of antibiotic metabolites of soil microorganisms by plants," *Nature* 167: 347-349.
3. Davis, D. and J. W. Rothrock "Localized systemic activity of griseofulvin in the control of alternaria blight of tomato" (Mimeographed).
4. DiMarco, O. R. and B. H. Davis *1956* "Prevention of decay of peaches with post-harvest treatments" (abstract) Northeast Division, American Phytopath Society Meetings.
5. ———, ———, *1956* "Prevention of decay of strawberries by post-harvest treatments" (abstract) Northeast Division, American Phytopath Society Meetings.
6. Fischer, Carl D. *1956* "Root-dip treatment improves plant development" *Farm Research*, Vol. 18, No. 3, pg. 10.
7. Groves, A. B. *1956* "Apple powdery mildew control studies (abstracts) Northeast Division American Phytopath Society Meetings.
8. Hilborn, M. T. and F. H. Lathrop *1950* "Organic fungicides in the control of apple scab and European red mite. *Phytopath*, Vol. 41, No. 1, pg. 52-55.
9. McCallan, S. E. A., "The nature of the fungicidal action of copper and sulfur. *Botanical Review*, Vol. 15, No. 9, pp. 629-643 *1949*.
10. McCallan, S. E. A. and Lawrence P. Miller. "Fungus Spores in Reducing Sulfur to Hydrogen Sulfide Produce an Equivalent of Carbon Dioxide." Phytopath abstract, Vol. 1, pp. 20 *1956*.
11. Miller, L. P., S. E. A. McCallan and R. M. Wood *1954* "The use of radioisotopes in studying the affinity of various toxicants for fungus spores." Radioisotope Conference, Vol. 1.
12. Stubbs, J. *1952* "The evaluation of systemic fungicides by means of *Alternaria solani* on tomato. *Ann. Appl. Biol.* 39: 439-441.
13. Szkolnik, M. *1952* "Root-dip treatment improves plant development" *Farm Research*, Vol. 18, No. 3, pg. 10.
14. Zaumeyer, W. J. "Control of powdery mildew with two antibiotics," presented at Antibiotic Conference held in Washington, D. C.
15. Zaumeyer, W. J. and R. R. Webster *1956* "Control of several fungus diseases of beans and lima beans with antibiotics" (abstract) Phytopath. 46: 470.
16. Weed, Richard M., S. E. A. McCallan and Lawrence P. Miller *1953* "Factors associated with the fungitoxicity of ferbam and nabam." Contrib. Boyce Thompson Inst. 17, Vol. 5, pg. 299-315.

ALABAMA CONFERENCE

(*From Page 45*)

Mr. Broadus cited two problems in this connection: (1) The grower of small acreages of cotton who will use a hand duster. "Frankly I don't know what to recommend for these people." The manufacturer recommendations for using rubber gloves, raincoats, boots, and hats will not

DON'T LET THIS HAPPEN

Disperse With

POLYFON.

The insecticide that settles to the bottom of the spray tank does not get uniformly spread on the crops. The insecticide that plugs the spray lines and nozzles is a nuisance. Avoid these and other dispersing problems in your formulations by using low cost POLYFON as a dispersant.

Whether it is DDT, TDE, Heptachlor, Dieldrin, Toxaphene, Aldrin or other active toxicants, there is a grade of POLYFON that will disperse effectively in amounts from 1.5 to 3% based on total formulation weight.

All grades of POLYFON are available at the same low price and in tonnage quantities. All have the same excellent storage properties and resistance to caking.

Send for Bulletins 301 and 306 describing these sodium lignosulfonates and their use in wettable insecticide powders.

Polychemicals DIVISION
West Virginia Pulp and Paper Company
CHARLESTON 4, SOUTH CAROLINA

Quality?

IT'S IN THE BAG!

REPUBLIC

SULPHATE OF AMMONIA

Top-quality Republic Sulphate of Ammonia is available bagged for direct application, or by carload lot in bulk form for mixing your own blends of high-nitrogen fertilizer.

And because Republic is one of the largest producers of Sulphate of Ammonia, you are assured of prompt delivery at regularly scheduled intervals to meet your requirements.

Order Republic Sulphate of Ammonia today. Call or write:

REPUBLIC STEEL

GENERAL OFFICES • CLEVELAND 1, OHIO

Export Department: Chrysler Building, New York 17, N. Y.

Bindweed Canadian Thistle Johnson Grass
Leafy Spurge Bermuda Grass Quack Grass
Para Grass Russian Knapweed Hoary Grass

Kill these and all other weeds and grasses *with one chemical*–

Oldbury® Sodium Chlorate

Kills germinating seeds as well as growing roots. Get 99% pure Oldbury sodium chlorate in 100-pound steel drums.

For helpful literature on handling and suggested application methods, write

Oldbury Products Sales Office
19 Rector Street
New York 6, N. Y.

OLDBURY PRODUCTS

HOOKER ELECTROCHEMICAL COMPANY

HOOKER CHEMICALS PLASTICS

OLDBURY 1896

Pyrethrum? Allethrin? *ask* MGK

As acknowledged pioneers and recognized authorities in the correct use of pyrethrum, allethrin and their most effective synergists, MGK 264 and piperonyl butoxide, we offer standardized concentrates, extracts, dusts of guaranteed uniformity.

If your aerosols, sprays, or dusts include the use of the powerful, safe and spectacular knockdown agents, pyrethrum and allethrin, send your inquiry today. All requests for information answered by qualified authorities. Write.

M cLAUGHLIN
G ORMLEY
K ING *Company*

1711 S.E. Fifth Street • Minneapolis, Minnesota

be followed by farmers in hot weather, because it is too uncomfortable to work in such protective clothing, he observed. (2) Airplane applications can also be quite dangerous, but the problem should be less for these users. Some aerial applicators have already used phosphate compounds successfully and know that care is essential. "The big problem from aerial applications will be the danger to tenants living in big cotton fields," he noted.

Mr. Broadus reported that the Mississippi Aeronautical Association and Delta Council are going all out to educate users of insecticides to the danger of phosphates. Both groups are preparing publications on safety measures to use with the compounds, and include such information as how soon fields may be checked after applications of phosphate compounds. "In Mississippi we may be too concerned about the danger of phosphate insecticides, but with the stress we are putting on it, I don't believe many people will be hurt. We know the phosphates can be used and without any deaths. However, if we try to use them like the chlorinated hydrocarbons, some deaths are likely. The key to safety is care in handling," he concluded.

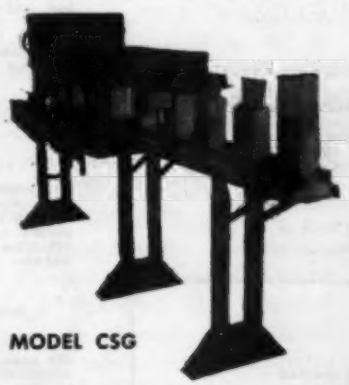
DEALERS have a big responsibility in the field of pest control, B. G. Hall, manager, Morgan County Exchange, Hartsell, told the proup. "We are responsible for providing the best available materials for our customers at the best prices, and we must be able to give them correct information on how to use the pesticides." An example he cited concerned rat poisons. "On our shelves are five brands of rat poison, all with exactly the same killing agent. Prices for these range from 98¢ to $1.69. I feel that my responsibility is such that I should tell my customers that these five poisons are the same and advise them to buy the cheapest one."

Turning his remarks to pesticide salesmen in the group, Mr. Hall said that salesmen have a big responsibility to dealers. "We need products that will do the job for our customers, and we need all the information possible on these products." He suggested that manufacturers purchase copies of all published research information from experiment stations on pest control and supply these publications to dealers with their products. Hall concluded by saying, "The salesman that I buy from must be able to tell me what the killing agent in the pesticide is, how it should be used, and how dangerous it is."

Although there are many insects that damage cotto.i, the boll weevil is still the most important cotton pest, declared R. L. Robertson, API Agricultural Experiment Station assistant entomologist. Therefore, he said, any insecticidal program must be planned around controlling this pest. For an effective insect control program, he advised insecticides or mixtures at the right time to control other major pests while controlling the weevil.

Applying insecticides before squaring is not recommended in Alabama unless the stand of cotton is being damaged by insects, reported Mr. Robertson. He cited results of experiments showing that the highest yields of cotton at the lowest cost result from controlling cotton insects while the crop is being set and matured.

Mr. Robertson listed the following insecticides as those recommended for controlling boll weevils in 1957: Dusts — 2.5 per cent aldrin - 5 per cent DDT; 3 per cent gamma BHC - 5 per cent DDT; 3 per cent BHC - 5 per cent DDT, alternated with calcium arsenate; 1.5 per cent dieldrin - 5 per cent DDT; 2 per cent endrin; 2.5 per cent heptachlor - 5 per cent DDT; or 20 per cent toxaphene. If resistance to the chlorinated hydrocarbon insecticides develops, he recommended using either 2.5 per cent Guthion - 5 per cent DDT; 20 per cent malathion - 5 per cent DDT; 2.5 per cent methyl parathion - 5 per cent DDT; or calcium arsenate. If calcium arsenate is used, a material to control aphids will be needed, he added.



MODEL CSG

The FRY MODEL CSG is a semi-automatic closing machine that double-folds, heat seals the inside of the bag and glues the second fold to the first. The result is a neat closure... heat-sealed for sift-proofness and glued for additional shipping or carrying strength. Operation is continuous and no reciprocating or cyclic motions are employed.

Adjustable for various bag heights. Model CSG also handles non-heatsealable bags by gluing folds.

FRY
SEALER-GLUER
BAG CLOSING
Machine

Ideal for

- INSECTICIDES
- FERTILIZERS
- CHEMICALS
- PLANT FOODS
- BRIQUETS
- MISCELLANEOUS POWDERS
- GRANULAR PRODUCTS

Write for informative folder on this and other models. Please submit bag and product samples.

GEORGE H. FRY COMPANY
42 EAST SECOND ST., MINEOLA, N.Y. TEL. Pioneer 6-6230

Practical Books For Your Library . . .

Soils and Soil Fertility

by L. M. Thompson

330 pages, $5.25 — This authoritative treatment begins by telling what soil is—what makes it up physically, chemically, biologically—and what its moisture-holding characteristics are. The use of commercial fertilizers and farm manure are other subjects under discussion.

Phosphates in Agriculture

by Vincent Sauchelli

175 pages, $2.75—It deals with the subject of rock phosphate versus superphosphate and colloidal phosphate; with the origin of phosphorus, the mining and processing of the phosphate rock, granulation of superphosphates, fixation of phosphates in the soil, losses of phosphorus and replenishments, phosphorus in nutrition, radioactive phosphorus, basic slag, fused and sintered phosphates and TVA research data on phosphates from field tests in 13 states.

Manual on Fertilizer Manufacture

Second and Enlarged Edition

by Vincent Sauchelli

$4.75—Complete volume on superphosphate and mixed fertilizer manufacture for the use of the operating men in the fertilizer works.

The Care and Feeding of Garden Plants

370 pages, $3.25 — Written by 14 leading specialists in plant nutrition, this profusely illustrated volume tells how to grow more plump, juicy vegetables, a finer lawn, healthier shade and fruit trees, more colorful garden flowers and house plants.

Books Sent Postpaid if Check is Enclosed with Order

Agricultural Chemicals
P. O. Box 31, Caldwell, N. J.

Enclosed is payment. Please send the books checked.

- ☐ Dust Diluents and Carriers—$4.75
- ☐ Handbook of Agricultural Pest Control — $3.25
- ☐ Insect Control by Chemistry — $15.25
- ☐ Chemistry and Action of Insecticides — $8.25
- ☐ Destructive and Useful Insects. Their Habits and Control — $12.75
- ☐ Insect Resistance in Crop Plants—$9.80
- ☐ Weed Control — $8.25
- ☐ Soils and Fertilizers — $6.25
- ☐ Soils and Soil Fertility — $5.25
- ☐ Phosphates in Agriculture—$2.75
- ☐ Manual on Fertilizer Manufacture — $4.75
- ☐ The Care and Feeding of Garden Plants — $3.25

*All prices above are in U.S.A. only — Add 50¢ for Foreign.

Name .....

Address .....

City, Zone & State .....

Handbook of Agricultural Pest Control

by S. F. Bailey and L. M. Smith

190 pages, $3.25—A practical handbook for the custom spray operator, the pest control operator, farm advisor, agricultural chemical salesman and field worker. This handbook covers the agricultural chemicals (insecticides, fungicides, herbicides, plant hormones and nutrient sprays, defoliant, etc.), their rates of application, useful formulas, as well as chapters on fumigation, spray machines, toxicology, dusts and dusting, aircraft, and mosquito control.

Handbook of Insecticide Dust Diluents & Carriers

by D. E. Weidhaas and J. L. Brann, Jr.

Commercial information and data based on research conducted at Cornell University and that supplied by basic manufacturers of the insecticide dust diluents and carriers. $4.75.

Insect Control by Chemicals

by A. W. A. Brown

817 pages, $15.25 — This text classifies the insecticides and gives their chemical, physical properties; discusses the hazards to avoid in formulation, mixing and use of compounds; and illustrates modern application equipment.

The Chemistry and Action of Insecticides

by H. E. Shephard

504 pages, $8.25 — This new book gives a vast wealth of information on insecticides—their chemical, physical, and toxicological aspects. Covers these chemical groups: Arsenical Compounds; Fluorine Compounds, Sulphur Compounds; Copper Compounds; Inorganic Substances; Nicotine; Rotenone; Petroleum, Soaps, Creosotes; Synthetic Organic Insecticides.

Destructive and Useful Insects Their Habits and Control

by C. L. Metcalf and W. P. Flint

1071 pages, $12.75 — This authoritative guidebook covers hundreds of both useful and destructive insects—treating the inner and outer structure and form of general species. Here are descriptions of more than 500 types of insect pests of the U. S. and Southern Canada.

Insect Resistance in Crop Plants

by Dr. Reginald H. Painter

520 page, $9.80—Here is a complete analysis of the relationship between crops and phytophagous insects together with a full analysis of the insect resistant varieties of important crops, such as wheat, corn, cotton, sorghums, potato.

Weed Control

by W. W. Robbins, A. C. Crafts, and R. N. Rayner

543 pages, $8.25 — Here is an authoritative, thorough book. Based on experience, research and experiment, it shows what methods of weed control have proved most effective for weeds of all species—shows how and when to apply a control measure, the season and rate of application, dosage, etc., and outlines the materials and machinery needed.

Soils and Fertilizers

by F. E. Bear

375 pages, $6.25 — This text presents the basic scientific facts and principles behind the production and utilization of agricultural chemicals.

When plants are fruiting freely and 25 per cent or more of the squares are punctured, 10 to 20 pounds per acre of the recommended insecticides should be applied, he stated. Best results are usually obtained by making three applications at five-day intervals and repeating the treatment when needed. When migration starts, he advised reducing the interval to four days. As sprays, equivalent amounts of these insecticides, except calcium arsenate, can be applied as emulsions in 2 to 8 gallons of spray per acre.

He said the schedule for boll weevil control will usually control bollworms, cotton aphids, and thrips. Spider mites are often difficult to control and control varies with the species, he noted. In general, 15 to 20 pounds per acre of 5 per cent aramite, 5 per cent malathion, 1 per cent parathion, or 2.5 per cent methyl parathion should be applied every 4 to 5 days until control is obtained. These materials are also effective as sprays. One application of ¼ pound demeton per acre will control all species of spider mite, he explained.

When cutworm damage appears, covering seedling plants and surface of ground along rows with 15 to 20 pounds per acre of 20 per cent toxaphene dust or equivalent as a spray will give control, Mr. Robertson observed. Seed corn maggots may seriously affect the stand of cotton, particularly when planting soon after turning under a green manure crop. Control can be had by using 2 ounces of aldrin, dieldrin, endrin, heptachlor, or lindane in a wettable powder mixed with a suitable fungicide per 100 pounds of seed. Seed should be treated immediately before planting, he advised.

A forum on "What's New in Pesticides" by industry representatives gave the pest control workers a glimpse into the future. James Lanier of Chemagro Corporation reported that Guthion was being released for general cotton use this year. He said only small amounts will be available this year, since the material is being produced in Germany. Excellent results, at ¼ pound per acre, in controlling resistant weevils were cited by Mr. Lanier. Another new product he described was Def, a cotton defoliant that will be available this year. Good results under varying conditions have resulted from using 2 pounds per acre, he concluded.

Sevin, a new insecticide for fruit, vegetable, and cotton insects, was reported by Harry Vincent, Carbide and Carbon Chemicals Corp. Available for experimental work only this year, Sevin is a low toxicity material that is neither a chlorinated hydrocarbon nor organic phosphate, he said.

Dale Young of Rohm and Haas reported that their new miticide, Kelthane, gives high initial kill and has a long-lasting residual effect. Available as a wettable powder and emulsifiable concentrate, Kelthane can be used on fruits, vegetables, and cotton, he said. Mr. Young also discussed Perthane, a chlorinated hydrocarbon, that is effective against many fruit and vegetable insects. He said it can be used on fruit and vegetables just prior to harvest.

Phosdrin, a Shell Chemical Co. product, was discussed by W. R. Smith, who said its toxicity is comparable to parathion, and that it can be used on vegetables shortly before harvest because its general half life is only 14 hours. It was listed as a systematic phosphate compound.

"Almost fantastic" was the way W. C. Shaw, USDA plant physiologist of Beltsville, Md., described progress in chemical weed control during the past 10 years. He pointed out that chemicals are being applied for weed control on one out of every 10 acres of cultivated land in the nation. He cited a survey that revealed that 33½ million acres were sprayed for weed and brush control in a single year. This compares with 29 million acres sprayed for controlling diseases and insects.

About 70 per cent of the acreage sprayed and dusted for weed control was treated by farmers using their own equipment, he said. Cost of material on this acreage amounted to $25 million. Custom operators furnished and applied the herbicides

Danitra

COMPLETE PACKAGING and FORMULATING SERVICE for manufacturers and distributors of LIQUID and WATER-SOLUBLE FERTILIZERS

Let Davies Do It—We have the plant, the equipment and the experienced personnel to render dependable, highly accurate packaging and formulating service on a custom basis. Your own trade marked containers in units of 1 pound or more.

Features of Davies Service:

1. Modern Plant — Extensive Facilities
2. Prime Source of Raw Materials
3. Technical Know-how
4. Low Cost
5. Complete Packaging under Your Own Label
6. Eliminates Manufacturing Investment for Customer

Blend in the finest of

TRACE ELEMENTS

In Your Fertilizer With

NUTRAMIN

a completely soluble blend of Manganese, Iron, Copper, Zinc, Boron and Molybdenum in scientifically controlled proportion

Davies Nitrate Co.

INCORPORATED

118 LIBERTY STREET NEW YORK 6, N. Y.

Now, a stronger thread for bags—at low cost!

BAGS SEWN WITH "SUPER CORDURA" withstand rugged handling, reducing spillage sharply.

"SUPER CORDURA" permits use of smaller needles, preventing material loss due to sifting.

SAVE TWO WAYS WITH NEW DU PONT "SUPER CORDURA"

REG. U. S. PAT. OFF.

High Tenacity Rayon

- **Bags sewn with it cost less**
- **Cuts cost of closing operation**

Du Pont "Super Cordura"* gives you greater seam strength—yet bags sewn with it cost you less. Drop tests prove this strength minimizes the danger of seam breakage.

"Super Cordura" saves you money in your own closing operations, too. It lets you use one size thread for most jobs, meaning reduced thread inventory. And it's treated with a special finish to insure good sewability.

Consider the advantages of bags sewn with Du Pont "Super Cordura" the next time you order multiwalls . . . and order it for use in closing, too.

E. I. du Pont de Nemours & Co. (Inc.), Textile Fibers Department, Wilmington 98, Delaware.

**"Super Cordura" is Du Pont's registered trademark for its high tenacity rayon yarns.*

DU PONT

REG. U. S. PAT. OFF.

Better Things for Better Living . . . through Chemistry

THREAD OF "SUPER CORDURA"... easier to sew ... costs less than conventional thread . . . extra-strong

for the remaining acreage at a total charge of about $22 million. These figures are for agricultural land only, he explained.

Mr. Shaw said the future rate of progress will be largely determined by: (1) The discovery of more selective, more specific, better translocated, more efficient, better formulated, and more economical herbicides. (2) a basic fundamental understanding of the effects of chemicals on plant growth and soils. (3) Our ingenuity in supplementing and combining chemical and cultural practices. (4) The development of new and more efficient weed control techniques.

Other speakers and their topics were: V. S. Searcy, API Agricultural Experiment Station assistant agronomist, control of wild onion and garlic; Lacy L. Hyche, Experiment Station assistant entomologist, ornamental insect control with systemic and conventional insecticides; E.F. Kennamer, API Extension fish and wildlife specialist, rodent control; R. C. Gaines, USDA Entomology Research Branch, Baton Rouge, La., cotton insect resistance to insecticides; R. L. Self, plant pathologist of the Ornamental Horticulture Field Station, Spring Hill, Ala., injury to container grown plants, and soilborne diseases of ornamentals; E. J. Cairns, Experiment Station nematologist, methods of applying nematocides; C. C. Fancher, regional supervisor, Southern Plant Pest Control Region, Gulfport, Miss., Mediterranean fruit fly; J. R. Cook, president, Alabama Pest Control Association, Decatur, Ala., importance of construction in termite control; T. J. Ratcliffe, chief inspector, Georgia Department of Entomology, Tifton, Ga., sweet potato mosaic; J. W. Kilpatrick, U.S. Public Health Service, Savannah, Ga., control of resistant flies and roaches; and George Blake, Experiment Station assistant entomologist, control of the imported fire ant.

The conference was sponsored by the Alabama Association for the Control of Economic Pests in cooperation with the School of Agriculture and Agricultural Experiment Station of the Alabama Polytechnic Institute.★★

WASHINGTON REPORT

(From Page 73)

work. However, the system at present is to pay more money for administrative personnel than for scientific personnel. This realignment by Dr. Shaw does not change this, but by changing branches to divisions, it is possible for all salaries to be raised, including those of scientists.

* * * * *

The Food and Drug Administration is getting closer to the question of establishing tolerances for pesticidal residues in milk. The decision to permit seven parts per million of DDT in beef fat opens the door for consideration of pesticidal residues in livestock and livestock products. The Food and Drug Administration's present position, however, clearly indicates that "no tolerance has been established for residues of DDT in milk."

In talking to the Food & Drug Administration this reporter was told that the Agency felt that it was more realistic to recognize that residues of DDT are being found in livestock, and to set safe tolerances in accordance with the law.

This line of reasoning, it would seem, would also include milk. However, the Food & Drug Administration at the time of my discussion was not prepared to discuss what its position on milk might be in the future. Several petitions are aiming at the question of milk, and Washington may well be forced into the position of making some decisions soon.

The decision to reaffirm the established tolerance for diphenyl on citrus is seen as touching off quite a reaction. The position of citrus growers was that they had a right to an exemption from the tolerance. However, the Food & Drug Administration feels that under the law a chemical which can cause harmful effects cannot be used without restriction, and that an exemption from the tolerance is not in the interest of public health. The next step, it would seem, is up to the citrus interests.★★

FERTILIZER VIEWS

(From Page 59)

of very minute traces of some of these elements. For example, molybdenum is needed by plants in the order of one part per billion of soil solution. It is now known that the minimal concentration of chlorine needed by plant tissues is about 100 parts per million of their dry weights. From these magnitudes one can understand why analytical methods must be so sensitive in determining them.

Animals require about the same elements as plants for their proper nourishment in addition to cobalt, sodium and iodine. Some evidence has been accumulated in favor of recognizing sodium as essential to many species of plants, and in time it too may be added to the growing list of essential micronutrients. Plants do not require, insofar as we now know, iodine and cobalt,—and animals do not require boron and molybdenum.

Pulverized Glass Nutrients or Frit

NUTRIENT glasses for plant feeding!? That was the question raised by an incredulous, eyebrow-raising neighbor when I started to tell him of this new development in agricultural chemicals. Adding micronutrient elements, such as copper, manganese, molybdenum to glass, to produce more efficient plant food is an interesting development and a triumph for modern industry. The usual chemical compounds as sources of these micronutrients in many cases have the disadvantage of dissolving too rapidly in the soil solution: in sandy soils the soluble salts tend to dissipate quickly through the subsoil and be beyond the reach of plant roots. Only a partial amount of the total nutrient applied actually feeds the plant. It is generally held that the chemical nutrient should dissolve in the soil because plants can only absorb their food in solution form. The problem put to industry was to prepare these chemical micronutrients in a form that would not have the disadvantages common to them as fertilizer materials. The an-

ARE YOU USING THIS

Proven Carrier

IN THE FAST GROWING FIELD OF

GRANULAR INSECTICIDES and HERBICIDES?

Terra-Lite® BRAND VERMICULITE

The use of granular toxicants for the control of insects and weeds is growing at a rapid rate. Terra-Lite brand vermiculite has already proven itself an ideal carrier. Two Terra-Lite "plus benefits" which will be major factors in further broadening this "new market" are: ease of application and the use of conventional equipment. Before deciding on your formulating plans in the granular field, consider the following other advantages of Terra-Lite vermiculite:

- **Lower carrier cost per lb. of finished product.**
- **Over 27,500,000 particles per lb. (28/65 mesh).**
- **High absorbency — free flowing even when high concentrations are formulated.**
- **Practically non-reactive.**
- **Release of toxicant is assured regardless of soil moisture conditions.**
- **Quick service—available from over 40 plants.**

Terra-Lite®

Division of Zonolite Company
135 S. LaSalle St., Chicago 3, Illinois

SEND COUPON TODAY

Terra-Lite, Dept. AC47, Division Zonolite Company
135 S. LaSalle St., Chicago 3, Ill.

Please send latest data on commercial use of Terra-Lite vermiculite and also actual samples, as checked:

☐ FREE INSPECTION SAMPLE
☐ FREE WORKING SAMPLE

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

CALL ARMOUR

greatest name in fertilizers

READY TO SERVE YOU WITH

31 factories and offices

PHOSPHATE ROCK • TRIPLE SUPERPHOSPHATE
SUPERPHOSPHATE • SHEEP MANURE

ARMOUR FERTILIZER WORKS

GENERAL OFFICE, P.O. BOX 1685, ATLANTA 1, GEORGIA

YOU'LL GET GREATER YIELDS... GROW MORE #1'S...

THANKS TO CHEM-BAM'S EXCLUSIVE NEW STICKING AGENT!

Chem-Bam *with* **U-101**

Never before a blight fighter like Chem-Bam! The only fungicide with U-101, exclusive sticking agent that glues fungicide to vines, plants. *Not even rain or watering can wash away Chem-Bam.*

Result? Your crops get fullest protection. *You make full profits.* Plants are healthier. Yields per acre 10% greater, according to a leading agricultural college.

Easier to use. Mixes evenly, easily with water and insecticides. Gives finer distribution in area sprayed.

Contact your farm dealer or write:

CHEMICAL INSECTICIDE CORP.
129 Montague Street
Brooklyn 1, N. Y.
Phone: ULster 2-5200
Plant - Metuchen, N. J.

Free booklet on blight control on request.

TAKE PROPER STEPS

to assure uniform high quality products

USE BELL KAOLIN

Distributed by
WHITTAKER CLARK & DANIELS, INC.
"The Talc House"
260 West Broadway New York 13, N. Y.

Produced by the
BELL Kaolin Mine — Batesburg, S. C.

Most economical because it is Always dependable

Wire, Write or Call for Immediate Delivery

swer was found in fusing the chemicals with sand to give the desired degree of solubility.

Most glasses comprise silica with varying amounts of calcium, sodium, potassium, iron and sometimes boron—all of which, except silica, are plant nutrients. If these and similar nutrients could be present in adequate amounts, and the solubility of the glass controlled within certain limits, the problem would be solved. This has been accomplished.

The formulated raw materials are mixed thoroughly, fused and at a predetermined temperature the molten mass is quenched in cold running water. This quick cooling shatters the mass into small pieces which are further cooled, dried and pulverized to size. This process is called fritting,—and the material, "frit."

Extensive field tests in South Carolina, Florida and elsewhere here and abroad have demonstrated that these agricultural frits are efficient suppliers of micronutrients. Theories vary as to how these nutrients become available: some believe that it is possible for a plant to absorb its nutrient by contact exchange with the carrier; others maintain that roots can absorb a nutrient only if it is in solution. Perhaps the process of plant feeding is a result of both; that is, absorption occurs through the solubilizing action of ascorbic acid released from the root tips and partly by the similar action of soil acids, principally carbonic. These acids slowly disintegrate the pulverized frit and release the nutrients over a long period of time,—but in a sufficient amount to satisfy plant needs. When it is recalled that these elements need be present in the root zone solution in parts per million or billion, it is not difficult to accept the evidence reported from the investigating research centers.★★

SOIL FUMIGANT

(*From Page 47*)

cellent control of those organisms has been attained in celery, lettuce, tomato and pepper beds. In California, particularly, experiments with strawberries have been strikingly successful.

A number of application methods have been investigated and utilized. Feeding into irrigation systems, as mentioned, is often practical. In California, shallow injection techniques have come into prominence. This merely involves the mounting of thin shanks on 5-inch centers and injected 4-inches deep into the soil. This method has been employed on soils ranging from fine sands to heavy clays. (Soil free of clods and of sufficient moisture to germinate seeds is needed for successful control of weeds and fungi.) A smooth roller is used to press down the earth and "seal" the fumigant applied. Such shallow injections have been used on field plantings of column stock and certain other field ornamentals.

In addition to the foregoing, row placement of Vapam has proved satisfactory and economical for Gladioli; with such crops as celery, broadcast application, by means of a sprinkler system is popular.

Vapam shows extraordinary promise for the control of nematodes and soil pests in fruit tree re-plant areas. It has been employed, for example, on citrus, avocado and such deciduous tree tracts as peaches, plums and cherries. It is applied either in large quantities of water in basins around individual re-plant sites or, on gravelly, very porous soil, by overhead sprinklers. Grape re-plant areas are also so treated to control nematodes.

There is a good deal of potential for Vapam, too, in the home garden trade. This market has been explored in a preliminary manner and the novel soil fumigant has found acceptance in California, Texas, Arkansas and Florida. Negotiations are underway with several formulators and marketers of garden and household chemicals who are interested in retailing Vapam on a national basis.

It is anticipated that the main focus for such consumer level sale of Vapam would be on its use in treating lawns, hard-to-weed areas such as gravel driveways, walkways, patios, service areas and flower beds.★★

Handbook of Agricultural Pest Control

By S. F. Bailey and L. M. Smith

CONTENTS

The Commercial Agricultural Chemicals
Physical and Chemical Properties
Compatibility
Containers
Fumigants and Fumigation
Toxicology and Residues
Spray Oils and their Properties
Spraying Machines
Rates of Delivery of Spray Machines
Rates of Application for Sprays
Dusts and Dusting
Aircraft
Mosquito Control
Hazards
Miscellaneous Topics
Tables and Formulas
Terms and Symbols

Postpaid if check accompanies order.

TEAR OFF AND MAIL

INDUSTRY PUBLICATIONS, INC.
P. O. Box 31
Caldwell, N. J.

$3.25 in USA
$3.75 elsewhere

Enclosed is our check for $3.25 (Foreign and Canada $3.75) covering a copy of HANDBOOK of AGRICULTURAL PEST CONTROL. It is understood that we may return the book within ten days for a full refund.

Company .....

Address .....

By .....

ANALYSIS OF TRIPLE SUPERPHOSPHATE

(From Page 50)

3. A significant difference was found for collaborators' results between the first and seventh day of analysis, with the following exceptions:

a. Supplemental moistures, oven method, using air circulation.
b. Primary results—Total P_2O_5.
c. Primary and supplemental results—available P_2O_5.
d. Primary and supplemental results—water soluble P_2O_5.

The extent of such differences are tested using the analysis of variance shown in Tables 5a through 6b.

4. Collaborators could not agree in analysis within one day over all items analyzed. The only exceptions were in the following analyses:

a. Primary results—Total P_2O_5.
b. Primary results—Available P_2O_5.

Conclusions:

Specific

A. Moisture

1. Collaborators differed widely in moisture using the oven method with no air circulation. Average results over the two days ran from a high of 5.65% to a low of 2.51%: see Table I. Since careful preparation was used for all samples sent to a collaborator, the only conclusions which can be derived are:
   a. Moisture technics differ perhaps in types of furnaces, sample placement, quantity, etc.
   b. Laboratory atmospheric conditions differ widely.
   c. Care in handling samples when received differed widely with reference to (1a) above. Comments received from collaborators indicate differences in technic, equipment and sample placement. With reference to item (1b) above, Table VII has been prepared to show the differences existing in temperature and relative humidity inside and outside the labs.

   Item (1c) is based on conjecture, only.
2. The use of forced air in ovens gave slightly higher results as shown in Table II, for the collaborators running the supplemental as well as the primary results.
3. Vacuum ovens give lower moistures as previously found in the brief results in Study No. 1. The comparison as shown below was averaged over all collaborators and days.

Oven method		*Vacuum Method*
No air	Air Circ.	
4.22%	4.32%	2.36%

4. Moisture precision varied among the collaborators with the various test methods ranking from lowest to highest variability from Table II as follows:

Method	*Precision*
Oven—air circ.	0.306%
Oven—no air circ.	0.386%
Vacuum	0.396%

The precision over all collaborators for the official method is 0.456% as shown in the table I summary.

5. Difference in moisture levels existed between days for all methods of determination. The differences are as follows:

NFFI Study No. 3
Triple Superphosphate
Summary of Collaborators' Data
Primary vs. Supplemental Tests Avg'd. Over 2 Days

Table II

	Moisture						Citrate Insoluble				Available				Water Soluble			
	Primary Oven On Air No Circ.		Supplemental Oven Forced Draft		Vacuum Oven		Primary		Supplemental		Primary (1)		Supplemental (1)		Primary		Supplemental	
Collab.	Avg.	Pre. 3σ̄	Avg.	Pre. 3σ̄	Avg.	3σ̄	Avg.	Pre. 3σ̄	Avg.	Pre. 3σ̄	Avg.	Pre. 3σ̄	Avg.	Pre. 3σ̄	Avg.	Pre. 3σ̄	Avg.	Pre. 3σ̄
7	3.82	.321			2.22	1.341												
12	3.80	.261			2.32	.276												
20	4.66	1.296			2.97	.306	1.96	.159	1.90	.030	45.84	.627	45.90	.495	41.73	.685	41.29	.583
21	3.37	.336	3.92	.261			1.96	.291	2.17	.102	46.39	.438	46.19	.510	42.33	.291	42.33	.146
22	4.11	.351	4.17	.174			2.20	.351	2.01	.408	45.55	.933	45.74	.932	42.70	1.457	42.65	.583
23							1.63	.159	1.82	.540	46.46	.261	46.27	.816	42.21	.583	42.22	.291
24							1.78	.102	1.65	.438	46.36	.276	46.50	.423	40.96	.583	42.16	.350
25							2.23	.159	2.24	.102	45.87	.378	45.86	.452	42.68	1.238	42.61	---
26	4.48	.276	4.47	.363	2.50	.291	2.39	.177	2.36	.072	45.56	.867	45.54	.787	40.97	2.62	41.80	.874
27	4.67	.102	4.70	.423	1.78	.102	2.29	.219	2.36	.087	45.96	.510	45.89	.277	42.09	.495	42.65	.291
28	4.84	.147			2.37	.072	2.83	.147	2.39	.174	44.82	.219	45.26	.262				
Overall Avgs.	4.22	.386	4.32	.306	2.36	.396	2.14	.196	2.10	.216	45.87	.501	45.91	.550	41.96	.994	42.22	.390

Note:
(1) Calculated from primary total P_2O_5 results.

to Sell Rural Missouri
Use the
Missouri Ruralist
PUBLISHED BY CAPPER PUBLICATIONS . LARGEST AGRICULTURAL PRESS IN THE WORLD
Sales Offices: New York, Cleveland, Chicago, Topeka, Los Angeles and San Francisco

Moisture by days
Averaged over collaborators

Method	1st Day	7th Day	No. Collab.
oven—no air	4.21%	4.28%	25
oven—air circ.	4.30%	4.33%	4
Vacuum	2.26%	2.46%	6

The difference found over all collaborators using the various methods is quite small even though the analysis of variance verifies such differences as being significant. A question of what is a practical difference needs to be resolved by the committee.

B. *Total P_2O_5*

1. Collaborators differed significantly in total P_2O_5. The high, averaged over the two days, was found for collaborator No. 1 at 49.06% P_2O_5. The low was found for collaborator No. 8 at 47.51%. (See Table No. I.)
2. No difference recorded in average level between days. For over all collaborators the average total P_2O_5 was 48.01% both days.
3. The test precision in Study No. 3 was better than in Study No. 2, but not as good as in Study No. 1. This tends to verify the previous conclusion reached in Study No. 2 that precision suffers over a period of time. A comparison of the precision in the three studies is shown below:

Precision over all collaborators (I)

0.05 gm. Aliquots		3	Sample Used
Study No. 1 (2)	0.092	0.277	Triple super
Study No. 2 (3)	0.340	1.02	"Pure" salt
Study No. 3 (4)	0.177	0.531	Triple super

Notes: (1) Single analysis
(2) Overall methods of digestion run in one day
(3) Run over 3 day period
(4) Run over 2 day period

C. *Citrate Insoluble P_2O_5*

1. Collaborators differed widely in citrate insoluble primary results running from low of 0.59% for Collaborator No. 13 to a high of 2.58% for Collaborator No. 28. Results were averaged over the two days of test. (See Table I.)
2. The difference between results found on the two days averaged over all collaborators was as follows:

Citrate Insoluble
Averaged over all collaborators

	1st day	7th day	No. Collabs.
Primary results	2.15%	2.07%	25
Supplementary results	2.12%	2.08%	9

While the differences are found significant in the analysis of variance, the extent of the difference may not be considered critical by the committee.

4. Precision of citrate insoluble was found to be 0.357% over all collaborators in the primary results. (See Table I.)
5. The precision of supplemental results was not as good as the primary results: shown by the comparison in Table II. The small difference is not significant.
6. The wide variety of washing times used by the collaborators is shown in Table VIII with the levels of citrate insoluble and water soluble found by each collaborator.
Time of washing varied from a low of 29 minutes for Collaborator No. 1 to a high of 265 minutes for Collaborator No. 2. Such practice illustrates the committee's objectives of revealing differences in the individual interpretation of the mechanics of the official method.

D. *Available P_2O_5*

1. Using the primary total P_2O_5 and the primary citrate insoluble P_2O_5, the available P_2O_5 for each collaborator's results was calculated.
2. Collaborators differed in available P_2O_5 from a low for Collaborator No. 11 of 44.73% to a high for Collaborator No. 13 of 48.01%. The 3.28% difference is certainly of a serious nature, considering the tolerance limits for available P_2O_5 in various states. The effect on product price to the producer and consumer of triple superphosphate is unquestionably of a serious nature. (See Table I.)
3. The supplemental available P_2O_5 results were calculated using the total P_2O_5 from the primary results of collaborators and the supplemental results for citrate insolubles. A small difference in average available P_2O_5 is shown. (See Table II.)
4. The difference found between days on available P_2O_5 is shown below:

% Available P_2O_5
Averaged over all Collaborators

	1st Day	7th day	No. Collabs.
Primary results	45.88%	45.94%	25
Supplemental results	45.90%	45.92%	9

The differences were not found significant in the analysis of variance as shown in Table 5a and 5b.

5. The precision of available P_2O_5 was found to be 0.75% over all collaborators for the primary results. (See Table I.)
The precision of the supplemental results does not show improvement over the primary results for the special collaborators participating in this work. (See Table II.)

E. *Water Soluble P_2O_5*

1. Extreme differences among collaborators existed in the determination of water soluble P_2O_5. Collaborator No. 2 was low with 32.28% P_2O_5, while Collaborator No. 5 was high with 43.08% P_2O_5. (See Table I.)
2. Precision of water soluble testing leaves much to be desired. The precision over all collaborators was 1.98% P_2O_5. (See Table I.)
3. An improvement in agreement as to water soluble is noted in the results from the collaborators running the supplemental results. This group was higher in the water soluble results than all collaborators on primary results and they agreed very well in the supplemental program. (Collaborator No. 20 gave the lowest results in this work. (See Table II.)
4. Precision of test was noticeably improved in the supplemental work as shown in Table II. This indicates that prior leaching and stirring of the sample for extraction of the water soluble may be a practice which could in general improve method mechanics for high analysis goods.
5. The difference between days averaged over all collaborators was found as follows:

Percent Water Soluble P_2O_5
Averaged over all Collaborators

	1st Day	7th day	No. Collabs.
Primary results	41.41%	41.13%	25
Supplemental results	42.22%	42.21%	8

F. *Free acid as H_3PO_4*

1. Collaborators differed widely in level of free acid. Collaborator No. 9 reported a high of 7.28%. Such results may only indicate inexperience with the acetone extraction method or may indicate the need for spelling out operating instructions in more detail. (See Table I.)
2. Precision of test varied widely among collaborators. The average precision over collaborators was found to be 0.466%
3. The difference in results for the two days is shown below:
Percent Free Acid—Averaged over all Collaborators
1st Day.....3.02%
7th Ray.....2.79%
(The collaborators in general found lower free acid in the sample on the seventh day.)
4. The free acid method used in the study is used by laboratories doing extensive superphosphate analyses. Many laboratories used the water soluble extract for free acid. So far no real finite method other than ether extraction has been developed.

TYPE-41

KAOLIN CLAY

For Use in Extending Insecticidal Materials

- Non-Abrasive
- Small Particle Size
- Chemically Adaptable
- Good Adhesive Qualities

For information and samples, write:

SOUTHEASTERN CLAY COMPANY

AIKEN, SOUTH CAROLINA

WISCONSIN ALUMNI RESEARCH FOUNDATION

LABORATORY SERVICES

Biological evaluation of insecticides
Screening of compounds for insecticidal, fungicidal, and bactericidal properties
Bioassay of insecticide residues on crops
Chemical determination of insecticides

Pharmacology including warm-blooded toxicity studies
Warfarin assays—physico-chemical and biological
Other biological, chemical, and microbiological services

PROJECT RESEARCH AND CONSULTATION

Write for Price Schedule

WISCONSIN ALUMNI RESEARCH FOUNDATION

P.O. Box 2217-B • Madison 1, Wisconsin

Acknowledgements:

The scope of the work covered in this paper is not limited to the work of the authors. Many people are concerned in such an effort.

To ennumerate all would occupy an excessive amount of copy. The collaborators are listed. The authors and the Chemical Control Committee express their thanks for the splendid cooperation displayed.

To the U.S.D.A. for helpful advice in guiding the progress of the program in the persons of Messrs. W. L. Hill, K. D. Jacob, and Hoffman, grateful thanks.

To Mr. V. Sauchelli, Davison Chemical Company, whose advice and leadership in the program was invaluable, the authors' thanks are extended.

To all who gave of their time and talent to this study, thanks are extended for aid in the studies.

Selected Statistical References

1. Statistical Analysis in Chemistry and the Chemical Industry—Bennett & Franklin—John Willey & Sons—1954
2. The Design and Analysis of Industrial Experiments—Davies—Hafner Publishing Company—1954
3. Statistical Methods—Snedecor—The Iowa State College Press—Fourth Edition 1946
4. Quality Control and Industrial Statistics—Duncan—Richard D. Irwin, Inc.—1952
5. A.S.T.M. Manual on Quality Control of Materials—Special Technical Publication 15 C—American Society for Testing Materials—1951
6. Statistical Quality Control—Grant—McGraw Hill Book Company—1946.

EDITORIAL COMMENTS

(*From page* 29)

formulators, they are seeking to keep the product in the hands of the stronger, most reputable and financially stable factors in the formulating end of the business, and they will exercise some control over labeling, strength of formulation and claims in advertising copy.

We can think, as every one else with experience in this industry can, of numerous products that have laid an egg for one reason or another. Perhaps they were rushed on the market too fast. Perhaps excessive claims were made for them, or inferior, under-strength formulations were supplied to users. Perhaps the developer of the material insisted on selling for top dollar, and tried to by-pass the formulator or the distributor. Perhaps he made the mistake of directing all his publicity, educational and selling effort at the final user, ignoring the fact that the essential middle men along the line have to know all about the product and be sold on it before they can honestly present a case for it to the dealer or the eventual user. There are lots of ways to torpedo even a good product before it actually gets to market.

Let's try to see that the industry doesn't fall into these old familiar errors with this promising new product. If we have to make errors, let's at least find some new ones.

CLASSIFIED ADVERTISING

Rates for classified advertisement are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. *Check must accompany all classified advertisements.* Address all replies to Classified Advertisements with Box Number care of AGRICULTURAL CHEMICALS, P. O. Box 31, Caldwell, N. J. Closing date: 10th of preceding month.

Situations Wanted:

ENTOMOLOGIST CUM CHEMIST: M.S. Cornell plus eight years experience in formulation, evaluation, residue analysis & field testing of Pesticides. Age 34, married, overseas considered. Address Box 160, c/o **Agricultural Chemicals.**

DISABLED VETERAN has degrees in agronomy and plant pathology. Eight years personal experience in the sales, use, and formulation fertilizers, fungicides, and insecticides. Seeks managerial position in the field of agricultural chemicals-manufacture or research. Address Box 161, c/o **Agricultural Chemicals.**

THIRTY-FOUR years of age with 8 years experience in research, product development and technical sales for large agricultural concerns. Supervisory experience. Bachelor of Science degree in entomology plus graduate work. Married wit'. family, willing to re-locate. Desire responsible position in technical development in sales. Address Box 158, c/o **Agricultural Chemicals.**

ENTOMOLOGIST: Desires to represent major manufacturer of Agricultural Chemicals for the South Texas and Northern Mexico areas. Address Box 159, c/o **Agricultural Chemicals.**

NAC CONFERENCE

(*From Page* 41)

Mr. Hatch suggested that the solution of economic problems must come primarily from a better selling effort, which can be developed only through better training of sales organizations right down to the dealer level.

Forest Pest Control

ROBERT L. Furniss, USDA, Forest and Range Experiment Station, in a report on the "Growing Market in Forest Pest Contral" outlined the problems of forest pest control, and reported the value of forest products to be in the neighborhood of 2 billion dollars annually. He pointed out that in forest pest work the need for toxicological and residue studies is relatively lower than for pest control in agricultural crops, and that insect tolerance to chemicals is not so much of a problem because of less frequent applications.

Thus far, he said, DDT has been used in aerial applications against hemlock looper and tussock moth. Trichlororobenzene and pestachlorophenol are used against powder post beetles, 2,4-D and 2,4,5-T are in wide use for control of blister rust. Some 215 million gallons of creosote and related petroleum products were used as wood preservatives in 1955.

"We are still looking for cheaper and better ways to control many destructive forest insects.—The solution of forest pest and related forestry problems will require cooperative efforts by many specialists in both the agricultural chemicals and forestry industries."

DISCUSSING the training of men for the agricultural chemicals industry, Stanley B. Freeborn, provost, University of California, warned that schools make a serious mistake when they train future scientists in highly specialized fields at the expense of giving them a broad, liberal education. He said that in general, those who have technical training alone make good bench men, but those who also have liberal arts experience have the broad vision needed in management positions.

Dr Freeborn added, "We might just as well face the fact that we are living in a mechanical and chemical age that becomes more dependent on physics, chemistry and biological sciences every day we live.

"Without disparaging any other subjects, it would seem evident that a knowledge of the sciences is as necessary to the graduate in the field of letters as a basic introduction to literature is to the potential scientists."

Survey of Uses Under PL 518

NAC members were interested in a report by John T. Coyne, USDA, Washington, D. C., giving the status of a survey made by the Pesticide Regulation Section of U. S. D. A. on registered uses to determine status under P. L. 518. The survey was confined to raw agricultural commodity uses.

The study began last July reviewing some 200 pesticide chemicals and approximately 4500 pesticide chemical uses . . . to determine which of the chemicals could safely be determined to be in compliance with PL 518 . . . "in compliance" is defined to mean that when used according to directions at the dosages and with limitations expressed on the label the chemical would leave no residue or leave residues within an established tolerance. Mr. Coyne said the charts are in the process of reproduction, and will be distributed in the next month or so.

He also mentioned that the charts are being compiled in consideration of all the tolerances or exemptions established by the Food and Drug Administration up to February 15, 1957 . . . including tolerances and exemptions established as a result of the 1950 hearings as well as under 518. Supplements will be issued periodically in the future.

The NAC spring meeting concluded with staff reports by Lea S. Hitchner, executive secretary, Jack Dreessen, Joseph Noone, Lee Grobe, in a panel report on "How NAC Serves the Industry," and what is done with the membership dollar.

PROFESSIONAL DIRECTORY

ALVIN J. COX, Ph.D.
Chemical Engineer and Chemist

(Formerly Director of Science, Government of the Philippine Islands. Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)

ADVISER ON AGRICULTURAL CHEMICAL PROBLEMS AND INVESTIGATIONS

Consultant in reference to spray injury and damage, claims, including imports of fruits and nuts, formulas, labeling, advertising and compliance with law.

1118 Emerson Street
Palo Alto, California

FLORIDA FIELD TRIALS

Evaluations
of
Agricultural Chemicals.

DR. G. R. TOWNSEND
Box 356
Belle Glade, Florida

Sperling Laboratories

Toxicology — Pharmacology
Physiology

Frederick Sperling, Ph.D.
Formerly Pharmacologist-in-Charge
Pharmacological and Rodenticide
Laboratory
U. S. Department of Agriculture

2170 N. Globe Rd. Arlington 7, Va.

Theodore Riedeburg Associates

Sales Consultants
and
Manufacturers' Representatives
on
Agricultural Chemicals

415 Lexington Ave.
New York 17, New York
MUrray Hill 7-1488

FRIAR M. THOMPSON, JR.
Consultant

Specializing in insecticides, rodenticides, fungicides, weed controllers for industry, household, and farm.
Product formulation, testing, labeling.

Athens, Georgia

RESEARCH, ANALYSIS
CONSULTATION

Toxicology, Pharmacology, Bacteriology, Biochemistry, Chemistry, Nutrition, Radiochemistry.

New Price Schedule Available
3755 Forest Park Avenue

SCIENTIFIC ASSOCIATES
St. Louis 8, Missouri
JEfferson 1-5922

AC on Microfilm

All issues of AGRICULTURAL CHEMICALS are available on Microfilm.

Librarians and other interested subscribers can contact University Microfilms, 13 North First Street, Ann Arbor, Mich., for price information and copies.

SOIL & PLANT TESTS

SOIL FERTILITY PROBLEMS

EVALUATION OF AGRICULTURAL CHEMICALS

Dr. Wolf's Agricultural Laboratories
2620 Taylor St. Hollywood, Fla.

Have you a service to sell?
Are you a consultant . . .
a representative?
a salesman?

Offer your talents, your services, your facilities in the agricultural chemical industry's only professional directory.

Advertising rates on request.

N.Y. Phone: Barclay 7-7121
Caldwell, N. J.: Caldwell 6-5520

AGRICULTURAL CHEMICALS
P.O. Box 31 Caldwell, N. J.

---

this space reserved for
your advertisement

Make yourself known throughout the industry

E. H. SIEGLER, Ph. D.
(Formerly U. S. Department Agriculture)
Pesticide Consultant
Washington Representative

Preliminary appraisal of chemicals for control of pests of agricultural crops; field research with promising formulations for determination of pesticidal utility and residues; preparation of petitions for certification of usefulness.

201 Tulip Avenue, Takoma Park, 12,
WASHINGTON, D. C.
PHONE: JUNIPER 5-1555

INDEX to ADVERTISERS

African Pyrethrum Development Inc. .... Feb.
Agricultural Chemicals, Inc. ..... Mar.
American Agricultural Chemical Co. 16
American Cyanamid Co. ..... Mar.
American Potash & Chemical Corp. ..... Mar.
W. R. E. Andrews Sales, Inc. 103
Antara Chemical Div., General Aniline & Film Corp. 21
Armour & Co. 118
Ashcraft-Wilkinson Co. 17
Atlas Powder Co. ..... Mar.

Bagpak Div., International Paper Co. ..... 3rd Cover
Bell Clay Co. 118
Bemis Bro. Bag Co. 3
Berkshire Chemicals, Inc. 109
Bonneville, Ltd. ..... Feb.
Bradley Pulverizer Co. 22
Burlap Council, The 100

California Spray Chemical Corp. ..... Mar.
Carbide & Carbon Chemicals Co. 27
Capper Publications 120
Cela, GMBH 83
Chase Bag Co. ..... Mar.
Chemical Insecticide Corp. 118
Chemagro Corp. 72
Clark Equipment Co. ..... Mar.
Climax Molybdenum Co. 80
R. D. Cole Mfg. Co. ..... Feb.
Columbia Southern Chemical Corp. ..... Mar.
Combustion Engineering, Inc., Raymond Division 64
Commercial Solvents Corp. ..... Mar.
Continental Can Co., Shellmar Betner Div. 70
Cosden Petroleum Corp. ..... Mar.
Cox, Dr. Alvin J. 124

Davies Nitrate Co., Inc. 115
Davison Chemical Co., Dept. of W. R. Grace & Co. 63
Deere & Co., Grand River Chem. Div. .... Feb.
Diamond Alkali Co. 78
Dorr-Oliver Co. 90
Du Pont de Nemours & Co. 26, 116
Duval Sulphur & Potash Co. 17

Eastern States Petroleum Co. ..... Mar.
Eastman Chemical Products, Inc. ..... Feb.
Emulsol Chemical Corp. ..... Mar.
Escambia Chemical Corp. 54

Fairfield Chemical Div., Food Machinery & Chemical Co. 18
Floridin Co. 9
Frontier Chemical Co. ..... Mar.
Fry Co., Geo. H. 113
Fulton Bag & Cotton Mills 108

Geigy Chemical Co. 10
General American Transportation Corp... 106
General Reduction Co. 95
Glendon Pyrophyllite Co. 87
Grand River Chemical Division of Deere & Co. ..... Feb.
Greeff & Co., R. W. ..... Mar.
Grinnell Co. ..... Mar.

Heckathorn United & Co. 76
Hercules Powder Co. ..... 4th Cover
Hooker Electrochemical Co. 112
Hudson Pulp & Paper Corp. ..... Mar.
Huber, J. M. Corp. ..... Mar.

International Minerals & Chemical Corp. 8, 24, 25

Johns-Manville Co. 69
Johnson, C. S. & Co. ..... Mar.

Kelker Chemical Co. ..... Mar.
Kraft Bag Co. 51

La Crosse Breweries, Inc. ..... Mar.
Lilly Co., Eli 84, 85
Ludlow-Saylor Wire Cloth Co. ..... Mar.
Lummus Co. ..... Feb.

Magnet Cove Barium Co. ..... Mar.
McLaughlin Gormley King Co. 112
Merck & Co. 92
Michigan Chemical Corp. 97
Mine Safety Appliances Co. ..... Mar.
Minerals & Chemicals Corp. of America 55
Mississippi River Chemical Co. 23
Monsanto Chemical Co. 28, 60, 61

National Kaolin Products Co. 91
National Potash Co. 6
Naugatuck Chemical Division, U. S. Rubber Co. ..... Mar.
Niagara Chemical Division, Food Machinery & Chemical Corp. 58
Nitroform Agricultural Chmls., Inc. 101
Nitrogen Div., Allied Chem. & Dye Corp. ..... Between 66 and 67

Olin Mathieson Chemical Corp. 43

Penick, S. B. & Co. 46
Pennsylvania Salt Manufacturing Co. ..... Mar.
Phelps Dodge Refining Corp. 86
Phillips Chemical Co. ..... Mar.
Potash Company of America ..... 2nd Cover
Poulsen Co. ..... Mar.
Powell, John & Co. 43
Prentiss Drug & Chemical Co. ..... Mar.
Private Brands, Inc. ..... Mar.

Raymond Bag Corp. 94
Raymond Division, Combustion Engineering, Inc. 64
Republic Steel Corp. 112
Renneburg & Sons Co., Edw. ..... Mar.
Reideburg, Theodore Associates 124
Richardson Scale Co. ..... Mar.
Rohm & Haas Co. ..... Mar.

Scientific Associates 124
Shell Chemical Corp. 14, 15
Sinclair Chemicals ..... Feb.
Sohio Chemical Co. ..... Jan.
Southeastern Clay Co. 122
Spencer Chemical Co. ..... Mar.
Sperling Laboratories 124
Spraying Systems Co. ..... Mar.
Standard Agricultural Chemicals, Inc. 12
Standard Oil Co. (Indiana) ..... Mar.
Stauffer Chemical Co. ..... Mar.
Sturtevant Mill Corp. 105
Southwest Potash Corp. 22
Summit Mining Corp. 93

Tennessee Corp. ..... Mar.
Terminal News ..... Mar.
Texas Co. ..... Feb.
Texas Gulf Sulphur Co. 74
Thayer Scale Co. 107
Thomas Alabama Kaolin Co. 89
Townsend, Dr. G. R. 124
Tractomotive Corp. ..... Feb.

Union Bag-Camp Paper Corp. 88
U. S. Borax & Chemical Corp. 19
U. S. Industrial Chemicals Co. 110
U. S. Phosphoric Products, Div. Tennessee Corp. 11
U. S. Potash Co. 13

Vanderbilt Co., R. T. 99
Velsicol Chemical Corp. 4
Vulcan Containers, Inc. 53

West End Chemical Co. 102
West Virginia Pulp & Paper Co. 111
Willson Products, Inc. ..... Mar.
Wisconsin Alumni Research Foundation.. 122
Woodward & Dickerson, Inc. ..... Mar.

Young Machinery Co. ..... Mar.

Zonolite Co. 117

TALE ENDS

THOSE who made the long trip out to San Francisco to attend last month's spring meeting of NAC may have been participating in an historic session, for the report which reaches us is that the NAC board has decided to discontinue spring meetings in the future. There has long been a feeling among some on the NAC board that it is a hardship to take time out for a meeting right at the busiest period of the year, and that a single annual meeting should suffice in any case.

AC

The plan for the future, as we understand it, is to continue the annual meeting this year at Spring Lake, as usual, in September. In future years the date would be moved back to October, after the growing season is more definitely over in the northern areas. The site of the meeting would be moved from year to year, to keep alive one of the ideas behind the spring meeting of taking the association session to a different geographical area each year.

AC

We got rather a shock a few weeks back when we learned that Shell's retirement program will result in Fred Hatch, manager of Shell's agricultural chemical division, retiring at the end of this year. We have always thought very highly of the retirement programs and pension arrangements which our top companies operate,—and would welcome the idea of someone readying a pension for us when it comes time to be put out to pasture. Occasionally, however, such programs seem to result in the automatic interruption of the career of a man who is obviously not yet ready for retirement. We can't believe that a man with Fred's vigor and enthusiasm, who has served as one of the most active and best informed presidents of NAC, is ready for the shelf,—nor that he will entertain any thought of staying there.

AC

Boll weevil resistance was the topic of a hundred conversations at the Fairmont, as it has been among entomologists and pesticide experts ever since the first reports came out of Louisiana some eighteen or twenty months ago. There is still rather strong opinion in some quarters, incidentally, that resistance has yet to be proved. One pesticide sales manager drew a parallel for us in which he asserted that it would be just as logical to claim there is water-resistant fire. As he illustrated his point, a cup of water is adequate to put out a fire in a waste basket, but once it spreads and starts to burn down the house, gallons won't do the job. Yet, he reminds, we don't refer to water-resistant fire.

AC

We have a feeling, however, that methyl parathion will still sell at a rapid rate down in the delta area this season. Whether there are or are not resistant weevils, the growers there are sure convinced they have them. And every formulator we have talked to feels certain that '57 will be a big year for methyl parathion.

AC

There is still danger, of course, that it may be too big a year on the supply side. If the market is to be only among resistant weevils, producers of methyl parathion could soon run out of buyers, for the delta area where the resistance problem is centered is only so big. There seems to be a fair prospect, however, that this hot new product for '57 may also find a field for itself in control of the spotted alfalfa aphid. This would work out just fine all around.

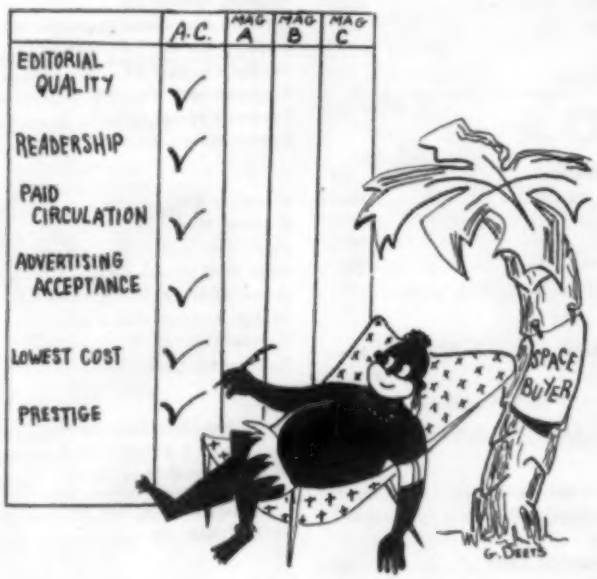
AC

Do you wish you could be a lot tougher on credit, but have the feeling that you don't want to offend and perhaps lose a profitable account? One of the strongest advocates of a vigorous credit policy told us recently that, by insisting on getting his money, he had never lost an account which he was not glad later he HAD lost. Maybe he has something there!

AC

We Nominate for Oblivion Department: The guys who planned two big pesticide meetings out in Memphis for this winter, exactly a week apart. Just too long for anyone to arrange to stay over,—and mighty rapid to be getting back to the vicinity of Beale Street on the return trip.

The Vote is for the Top Book



WHEN examining every point of comparison, there is no doubt that the leading magazine in the agricultural chemical field is, of course,

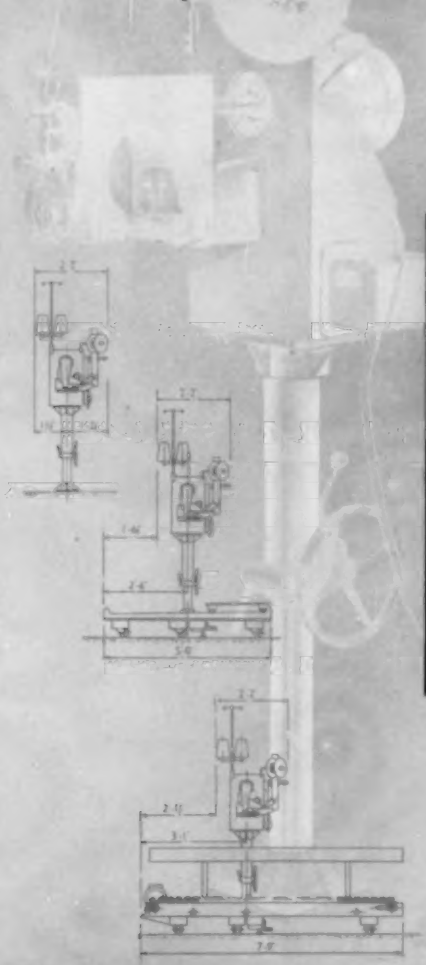
AGRICULTURAL CHEMICALS

Caldwell **New Jersey**

Member Audit Bureau of Circulations

NOW AND NEW!

If you bag any product—
The new and augmented **BAGPAK® CLOSER** line offers you an economy machine for any need.



These new machines are geared for fast production, to meet your cost-reducing requirements. You pay lower prices for new machines that close bags faster and better—a double saving that means better profits.

THE NEW BAGPAK® CLOSERS ARE—

- ▶ ADAPTABLE TO ANY PRODUCT— ANY PURPOSE—ANYTIME
- ▶ HIGH OR LOW SPEED— UP TO 15 BAGS A MINUTE
- ▶ USED FOR ALL TYPES OF BAGS— IN WIDE SIZE RANGE
- ▶ USED WITH OR WITHOUT CONVEYORS
- ▶ SIMPLE TO OPERATE—FULLY OR SEMI-AUTOMATIC
- ▶ APPLIES FAMOUS BAGPAK CUSHION STITCH —OR SEWS THROUGH COTTON OR PAPER FILLER CORD

Ask for Bagpak's experienced Planning and Service Engineers to explain the cost—and time-saving features of the new, low cost CLOSER line. Get lower cost, faster production—better looking packages—more efficient labor. Call for Bagpak Planning Service, or write—AC-4.

See our complete line of BAGPAK® CLOSERS at the American Feed Manufacturers Association Feed Show, Booths 195-196, Conrad Hilton Hotel, Chicago, May 1-2-3.

International Paper COMPANY
BAGPAK DIVISION
220 EAST 42ND STREET, NEW YORK 17, N.Y.

BRANCH OFFICES: Atlanta · Baltimore · Boston · Chicago · Cincinnati · Cleveland · Dallas · Denver · Kansas City, Kansas · Los Angeles Minneapolis · New Orleans · Philadelphia · St. Louis · San Francisco · IN CANADA: The Continental Paper Products, Ltd., Montreal, Ottawa, Toronto

LEADING GROWERS OF MANY CROPS DEPEND ON TOXAPHENE FOR SEASON-LONG INSECT CONTROL. FOR EXAMPLE, TOXAPHENE IS OFFICIALLY RECOMMENDED FOR CONTROL OF MORE COTTON INSECTS THAN ANY OTHER INSECTICIDE.

Agricultural Chemicals Division
Naval Stores Department

HERCULES POWDER COMPANY
INCORPORATED

970 Market Street, Wilmington 99, Del.

NX 96-11